YAMAHA

YAMAHA MOTOR CO., LTD.

YP-X

SERIES

OWNER'S MANUAL

Before using the “YP-X” series robot (Be sure to read the following notes.)

At this time, our thanks for your purchase of this YAMAHA “YP-X” series robot.

The “YP-X” series robot use absolute position detectors that do not require return-to-origin after turning on the controller power. However, when the controller power is turned on in the following cases, return-to-origin must be performed just the very first time.

(1) When robot cable was first connected after delivery from YAMAHA.
(2) When robot cable was disconnected from the controller and then reconnected.
(3) When no absolute battery is connected.
(4) When a motor or cable was replaced.

At this point, any of the following errors is issued immediately after controller power is turned on, but **this is not a malfunction**. The controller will operate normally by restarting.

When using DRCX or TRCX controllers:

15 : FEEDBACK ERROR 2
23 : ABS.BAT.L-VOLTAGE
24 : ABS.DATA.ERROR

When using a QRCX controller:

17.80 : D?.ABS.encoder backup error
17.81 : D?.ABS.encoder battery alarm
17.85 : D?.ABS.encoder system error
17.92 : D?.ABS.cable disconnected
17.93 : D?.ABS.data overflow
17.94 : D?.ABS.Battery degradation

[1] X, Y, Z axes

X, Y, Z axes use the stroke end origin detection method.
Set the origin position while referring to the following section in the robot controller instruction manual.

When using DRCX or TRCX controllers:

See “9-1-1 Return-to-origin by the search method” in Chapter 9.

When using a QRCX controller:

See “11-9 Absolute Reset” in Chapter 11.

⚠CAUTION

Changing the origin position may cause a positional shift or robot breakdowns, and should be avoided. Changing the origin detection method might also create a dangerous situation and should be avoided. If these must be changed, consult our sales office or dealer.

[2] R axis

On the above robots, the customer should set the origin at the desired position. Move the robot to the desired position and set it as the origin while referring to the following section in the robot controller instruction manual.

When using DRCX or TRCX controllers:

See “9-1-1 Return-to-origin by the search method” in Chapter 9.

When using a QRCX controller:

See “11-9 Absolute Reset” in Chapter 11.

After setting the origin position, affix the stickers (triangular stickers supplied with the robot) to both the tool side and workpiece side so that they can be used as the alignment marks. Use these marks as the reference position the next time the origin must be set.

Introduction

Our sincere thanks for your purchase of this YAMAHA robot and controller.
The YP-X Series were designed and developed as compact and highspeed Pick and Place (P&P) robots.
This manual contains important information on items such as an overview, handling, adjustment, and service of YP-X Series robots to ensure correct and efficient use. Please be sure to read this manual before installing the equipment.
Please refer to the "YAMAHA Robot Controller DRCX, TRCX, QRCX Instruction and Owner's Manual" for detailed information on operation and programming.

NOTES

- ◆ We reserve the right to make future product changes that might not be incorporated into this manual.
- ◆ We request the customer contact concerning any possible errors, omissions or misprints etc.

YAMAHA MOTOR CO., LTD.
IM Company

MEMO

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CHAPTER 1

Using the Robot Safely

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MEMO

1 Safety Information

Industrial robots are highly programmable, mechanical devices that provide a large degree of freedom when performing various manipulative tasks.
To ensure correct and safe use of YAMAHA industrial robots, carefully read this manual and make yourself well acquainted with the contents. FOLLOW THE WARNINGS, CAUTIONS AND INSTRUCTIONS INCLUDED IN THIS MANUAL. Failure to take necessary safety measures or mishandling due to not following the instructions in this manual may result in trouble or damage to the robot and injury to personnel (robot operator or service personnel) including fatal accidents.

Warning information in this manual is shown classified into the following items.

⚠ DANGER

Failure to follow DANGER instructions will result in severe injury or death to the robot operator, a bystander or a person inspecting or repairing the robot.

⚠ WARNING

Failure to follow WARNING instructions could result in severe injury or death to the robot operator, a bystander or a person inspecting or repairing the robot.

⚠ CAUTION

Failure to follow CAUTION instructions may result in injury to the robot operator, a bystander or a person inspecting or repairing the robot, or damage to the robot and/or robot controller.

It is not possible to detail all safety items within the limited space of this manual. So it is essential that the user have a full knowledge of basic safety rules and also that the operator makes correct judgments on safety procedures during operation. This manual and warning labels supplied with or affixed to the robot are written in English. If the robot operator or service personnel does not understand English, do not permit him (or her) to handle the robot.

2 Essential Caution Items

Particularly important cautions for handling or operating the robot are described below. In addition, safety information about installation, operation, inspection and maintenance is provided in each chapter. Be sure to comply with these instructions to ensure safe use of the robot.

(1) Observe the following cautions during automatic operation.

Warning labels 1 (Fig. 1-1) are affixed to the robot.

- Install a safeguard (protective enclosure) to keep any person from entering within the movement range of the robot and suffering injury due to being struck by moving parts.
- Install a safety interlock that triggers emergency stop when the door or panel is opened.
- Install safeguards so that no one can enter inside except from doors or panels equipped with safety interlocks.
- The warning labels 1 shown in Fig. 1-1 are supplied with the robot and should be affixed to a conspicuous spot on doors or panels equipped with safety interlocks.

⚠ DANGER

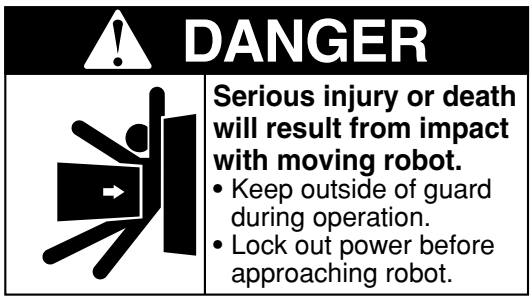
Serious injury or death will result from impact with moving robot.
• Keep outside of guard during operation.
• Lock out power before approaching robot.

(2) Use caution to prevent hands or fingers from being pinched or crushed.

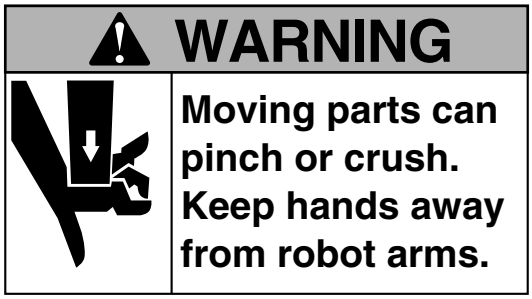
Warning labels 2 (Fig. 1-2) are affixed to the robot.

⚠ WARNING

Moving parts can pinch or crush.
Keep hands away from robot arms.


DANGER
Serious injury or death will result from impact with moving robot.
• Keep outside of guard during operation.
• Lock out power before approaching robot.

■Fig. 1-1 Warning label 1



■Fig. 1-2 Warning label 2

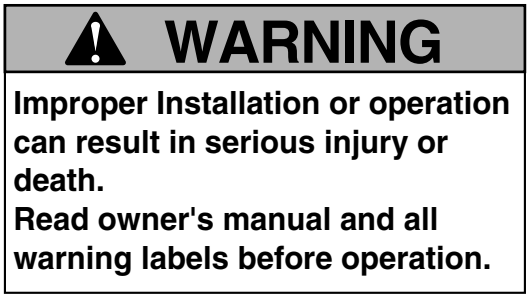
(3) Follow the instructions on warning labels and in this manual.

Warning label 3 (see Fig. 1-3) is supplied with the robot and should be affixed to the robot or a conspicuous spot near the robot.

- Be sure to read the warning label and this manual carefully and make your thoroughly understand the contents before attempting installation and operation of the robot.
- Before starting the robot operation, even after you have read through this manual, read again the corresponding procedures and cautions in this manual as well as descriptions in the this chapter (Chapter 1, "Using the Robot Safely").
- Never install, adjust, inspect or service the robot in any manner that does not comply with the instructions in this manual.

⚠WARNING

Improper installation or operation can result in serious injury or death.
Read owner's manual and all warning labels before operation.


⚠ WARNING
Improper Installation or operation can result in serious injury or death.
Read owner's manual and all warning labels before operation.

■Fig. 1-3 Warning label 3

(4) Do not use the robot in environments containing inflammable gas, etc.

⚠ WARNING

- **This robot was not designed for operation in environments where inflammable or explosive substances are present.**
- **Do not use the robot in environments containing inflammable gas, dust or liquids. Explosions or fire could otherwise result.**

(5) Do not use the robot in locations possibly subject to electromagnetic interference, etc.

⚠ WARNING

Avoid using the robot in locations subject to electromagnetic interference, electrostatic discharge or radio frequency interference. Malfunction may otherwise occur.

(6) Use caution when releasing the Z-axis (vertical axis) brake.

⚠ WARNING

The Z-axis will slide down when the Z-axis brake is released, causing a hazardous situation.

- **Press the emergency stop button and prop up the Z-axis with a support stand before releasing the brake.**
- **Use caution not to let your body get caught between the Z-axis and installation base when releasing the brake to perform direct teach.**

(7) Provide safety measures for end effector (gripper, etc.).

⚠ WARNING

- **End effectors must be designed and manufactured so that they cause no hazards (for example, loosening of workpiece) even if power (electricity, air pressure, etc.) is shut off or power fluctuations occur.**
- **If there is a possible danger that the object gripped by the end effector may fly off or drop, then provide appropriate safety protection taking into account the object size, weight, temperature and chemical properties.**

(8) Use the following caution items when removing the Z-axis motor.

⚠ WARNING

The Z-axis will drop when the Z-axis motor is removed, possibly resulting in injury.

- **Turn off the controller and set a support stand under the Z-axis before removing the motor.**
- **Use caution not to allow hands or body to be squeezed or crushed by moving parts on the Z-axis or between the Z-axis and the installation base.**

(9) Use the following caution during inspection of controller.

⚠ WARNING

- **When you need to touch the terminals or connectors on the outside of the controller during inspection, always first turn off the controller power switch and also the power source in order to prevent possible electrical shock.**
- **Never touch any internal parts of the controller.**
- **For more specific safety items on the controller, refer to the YAMAHA Robot Controller Owner's Manual.**

(10) Consult us for corrective action when the robot is damaged or malfunction occurs.

⚠ WARNING

If any part of the robot is damaged or any malfunction occurs, continuous operation may be very dangerous. Please consult YAMAHA dealer for corrective action.

Damage or Trouble	Possible Danger
Damage to machine harness or robot cable	Electrical shock, malfunction of robot
Damage to exterior of robot	Flying outwards of damaged parts during robot operation
Abnormal operation of robot (positioning error, excessive vibration, etc.)	Malfunction of robot
Z-axis brake trouble	Dropping of load

(11) Use caution not to touch the cooling fan on the controller rear panel.

⚠ WARNING

- **Bodily injury may occur from coming into contact with the cooling fan while it is rotating.**
- **When removing the fan cover for inspection, first turn off the controller and make sure the fan has stopped.**

(12) Use caution not to touch the high temperature part of the motor.

⚠ WARNING

The motor is extremely hot after automatic operation, so burns may occur if it is touched.
Before touching the motor during inspections or servicing, turn off the controller, wait for a while and check that the temperature has cooled.

(13) Do not remove, alter or stain the warning labels.

⚠ WARNING

If warning labels are removed or difficult to see, necessary cautions may not be taken, resulting in an accident.

- **Do not remove, alter or stain the warning labels on the robot.**
- **Do not allow the warning labels to be hidden by the device installed to the robot by the user.**
- **Provide proper lighting so that the symbols and instructions on the warning labels can be clearly seen even from the outside of safeguards.**

(14) Protective bonding

⚠ WARNING

Be sure to ground the robot and controller to prevent electrical shock.

(15) Be sure to make correct parameter settings.

⚠CAUTION

The robot must be operated with correct tolerable moment of inertia and acceleration coefficients according to the manipulator tip mass and moment of inertia. If this is not observed, premature end to the life of the drive units, damage to the robot parts or residual vibration during positioning may result.

(16) Do not use the robot for tasks requiring motor thrust.

⚠CAUTION

Avoid using the robots for tasks which make use of motor thrust (press-fitting, burr removal, etc.). These tasks may cause malfunctions of the robot.

3 Special Training for Industrial Robot Operation

Companies or factories using industrial robots must make sure that every person, who handles the robot such as for teaching, programming, movement check, inspection, adjustment and repair, has received appropriate training and also has the skills needed to perform the job correctly and safely.
Since the YAMAHA YP-X Series pick-and-place robots fall under the industrial robot category, the user must observe local regulations and safety standards for industrial robots, and provide special training for every person involved in robot-related tasks (teaching, programming, movement check, inspection, adjustment, repair, etc.).

4 Robot Safety Functions

(1) Overload detection

This function detects an overload applied to the motor and shuts off the servo power.

(2) Overheat detection

This detects an abnormal temperature rise in the controller's driver and shuts off the servo power.

If an overload or overheat error occurs, take the following measures.

1. Insert a timer in the program.
2. Reduce the acceleration coefficient.

(3) Soft limits

Soft limits can be set on each axis to limit the working envelope in manual operation after return-to-origin and during automatic operation.

The working envelope is the area limited by soft limits.

(4) Mechanical stoppers

If the servo power is suddenly shut off during high-speed operation by emergency stop or safety functions, these mechanical stoppers prevent the axis from exceeding the movement range. The R-axis has no mechanical stopper.

The movement range is the area limited by mechanical stoppers.

⚠ WARNING

Axis movement does not stop immediately after the servo power supply is shut off by emergency stop or other safety functions.

(5) Z-axis (vertical axis) brake (Option)

An electromagnetic brake can be installed to the Z-axis as an option, to prevent the Z-axis from sliding down when the servo power is turned off. This brake is working when the controller is off or the Z-axis servo power is off even when the controller is on. The Z-axis brake can be released by means of the programming unit or by a command in the program when the controller is on.

⚠ WARNING

The Z-axis will slide down when the Z-axis brake is released, causing a hazardous situation.

- **Press emergency stop button and prop the Z-axis with a support stand before releasing the brake.**
- **Use caution not to let your body get caught between the Z-axis and installation base when releasing the brake to perform direct teach.**

⚠ WARNING

Axis movement does not stop immediately after the servo power supply is shut off by emergency stop or other safety functions.

5 Safety Measures for the System

Since the robot is commonly used in conjunction with an automated system, a dangerous situation is more likely to occur from the automated system than from the robot itself. Accordingly, appropriate safety measures must be taken on the part of the system manufacturer according to the individual system. The system manufacturer should provide a proper instruction manual for safe, correct operation and servicing of the system.

6 Trial Operation

After installation, adjustment, inspection, maintenance or repair of the robot has been done, perform a trial operation using the following procedures.

(1) If a safeguard has not yet been provided right after installation of the robot, rope off or chain off around the movement area of the manipulator in place of the safeguard, and observe the following points.
- ① Use stable posts which do not totter easily.
- ② The rope or chain should be easily visible by everyone around the robot.
- ③ Place a conspicuous sign prohibiting the operator or other personnel from entering the movement range of the manipulator.

(2) Check the following points before turning on the controller.
- ① Is the robot securely and correctly installed?
- ② Are the electrical connections to the robot correct?
- ③ Are items such as air pressure correctly supplied?
- ④ Is the robot correctly connected to peripheral equipment?
- ⑤ Have safety measures (safeguard enclosure, etc.) been taken?
- ⑥ Does the installation environment meet the specified standards.

(3) After the controller is turned on, check the following points from outside the safeguard.
- ① Does the robot start and stop as intended? Can the operation mode be selected correctly?
- ② Does each axis move as intended within the soft limits?
- ③ Does the end effector move as intended?
- ④ Are the signal transmissions to the end effector and peripheral equipment correct?
- ⑤ Does emergency stop work?
- ⑥ Are the teaching and playback functions normal?
- ⑦ Are the safeguard and interlock working as intended?
- ⑧ Does the robot move correctly during automatic operation?

7 Work Within The Safeguards

(1) When work is required inside the safeguard enclosure, always turn off the controller and place a sign indicating that the robot is being adjusted or serviced in order to keep any other person from inadvertently touching the controller switch or operation panel, except for the following cases.
 1) Soft limit settings
 2) Teaching

For items 1), follow the precautions and procedure for each section. To perform item 2), refer to the description in (2) below.

(2) Teaching
When performing teaching within the safeguard enclosure, comply with the instructions listed below.
 1) Check or perform the following points from outside the safeguard enclosure.
  ① Make sure that no hazards are present within the safeguard enclosure by visual check.
  ② Check that the programming unit MPB or TPB operates correctly.
  ③ Check that no failures are found in the robot.
  ④ Check that emergency stop works correctly.
  ⑤ Select teaching mode and prohibit automatic operation.
 2) Never enter the movement range of the manipulator while within the safeguard enclosure.

8 Automatic Operation

Automatic operation described here includes all operations in AUTO mode.

(1) Check the following before starting automatic operation.
   ① No one is within the safeguard enclosure.
   ② The programming unit and tools are in their specified locations.
   ③ The alarm or error lamps on the robot and peripheral equipment do not flash.
   ④ The safeguard is securely installed with safety interlocks actuated.

(2) Observe the following during automatic operation or in cases where an error occurs.
   1) After automatic operation has started, check the operation status and warning lamp to ensure that the robot is in automatic operation.
   2) Never enter the safeguard during automatic operation.
   3) If an error occurs in the robot or peripheral equipment, observe the following procedure before entering the safeguard enclosure.
      ① Press the emergency stop button to set the robot to emergency stop.
      ② Place a sign on the start switch, indicating that the robot is being inspected in order to keep any other person from inadvertently touching the switch and restarting the robot.

9 Adjustment and Inspection

Do not attempt any installation, adjustment, inspection and maintenance that is not described in this manual.

10 Repair and Modification

Do not attempt any repair, parts replacement and modification not described in this manual. These works require technical knowledge and skill, and may also involve work hazards.

11 Warranty

The YAMAHA robot and/or related product you have purchased are warranted against the defects or malfunctions as described below.

Warranty description : If a failure or breakdown occurs due to defects in materials or workmanship in the genuine parts constituting this YAMAHA robot and/or related product within the warranty period, then YAMAHA will repair or replace those parts free of charge (hereafter called "warranty repair").

Warranty Period : The warranty period ends when any of the following applies:
(1) After 18 months (one and a half year) have elapsed from the date of shipment
(2) After one year has elapsed from the date of installation
(3) After 2,400 hours of operation

Exceptions to the Warranty : This warranty will not apply in the following cases:
(1) Fatigue arising due to the passage of time, natural wear and tear occurring during operation (natural fading of painted or plated surfaces, deterioration of parts subject to wear, etc.)
(2) Minor natural phenomena that do not affect the capabilities of the robot and/or related product (noise from computers, motors, etc.).
(3) Programs, point data and other internal data that were changed or created by the user.

Failures resulting from the following causes are not covered by warranty repair.

1) Damage due to earthquakes, storms, floods, thunderbolt, fire or any other natural or man-made disasters.
2) Troubles caused by procedures prohibited in this manual.
3) Modifications to the robot and/or related product not approved by YAMAHA or YAMAHA sales representatives.
4) Use of any other than genuine parts and specified grease and lubricants.
5) Incorrect or inadequate maintenance and inspection.
6) Repairs by other than authorized dealers.

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YAMAHA MOTOR CO., LTD. SOLE LIABILITY SHALL BE FOR THE DELIVERY OF THE EQUIPMENT AND YAMAHA MOTOR CO., LTD. SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES (WHETHER ARISING FROM CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY). YAMAHA MOTOR CO., LTD. MAKES NO WARRANTY WHATSOEVER WITH REGARD TO ACCESSORIES OR PARTS NOT SUPPLIED BY YAMAHA MOTOR CO., LTD.

12 CE Markings

For information about CE markings relating to cases in which the YAMAHA robot is exported to or used in European countries, refer to the separate “YAMAHA QRCX-E Robot Controller Owner’s Manual”.

13 Precautions

1) Accuracy may deteriorate due to external causes such as temperature and humidity and may result in equipment breakdowns. Use of the robot in air-conditioned facilities is recommended. Do not use in environments exposed to items such as oil, water, corrosive gases and metal powder etc.

2) When using the robot after an extended period of non-use, warmup the robot for about a 10 minute period with no workpiece installed. This will improved the sliding operation of the mechanism.

3) If the work (including the gripper or tool) is heavier than the maximum payload listed in the catalog or the robots own basic settings are changed, this may cause the robot itself to breakdown. Do not use the robot under such conditions.

4) Because of the one-sided support structure, the YP-X series manipulator arm droops downward slightly when it moves to the X-axis stroke end (forward end). For example, the manipulator arm will droop a maximum of 1.5 millimeters with a payload of 3kg, so take this into consideration during the application design stage.

5) If the robot movement duty is too high, errors such as "Overload" and "Overheat" may occur. In this case, increase the time that the robot axis is stopped by inserting a timer in the program, etc.

6) The YAMAHA pick and place robot uses the stroke-end origin detection method. In this method, a large electrical current flows through the motor, so avoid performing absolute reset frequently to prolong the controller and motor service life.

7) The axes on the YP-X series are belt-driven (see specifications). Using the motor to apply thrust (press-fit, etc.) may sometimes cause the teeth on the belt to jump free. So use caution not to apply a large force greater than the maximum payload listed in the specs for the Z-axis.

8) On the YP-X series, a slight residual vibration may sometimes occur during positioning of each axis due to the one-sided support structure and the belt drive. So install a timer if precise positioning is required.

CHAPTER 2

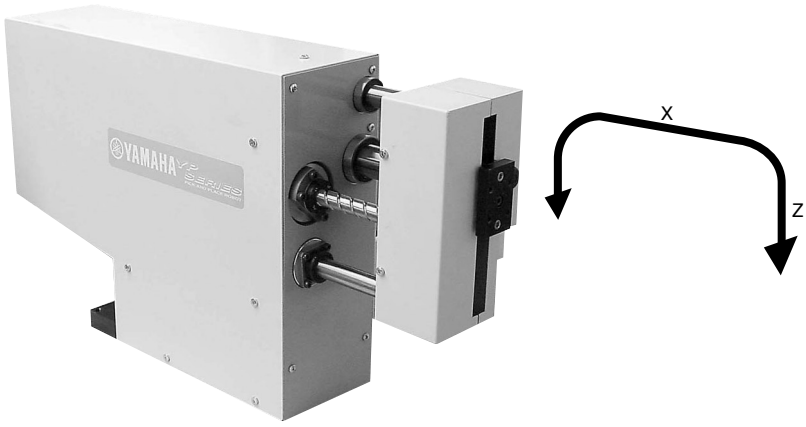
Functions

1 P & P robot unit 2-1
2 P & P robot controller 2-2

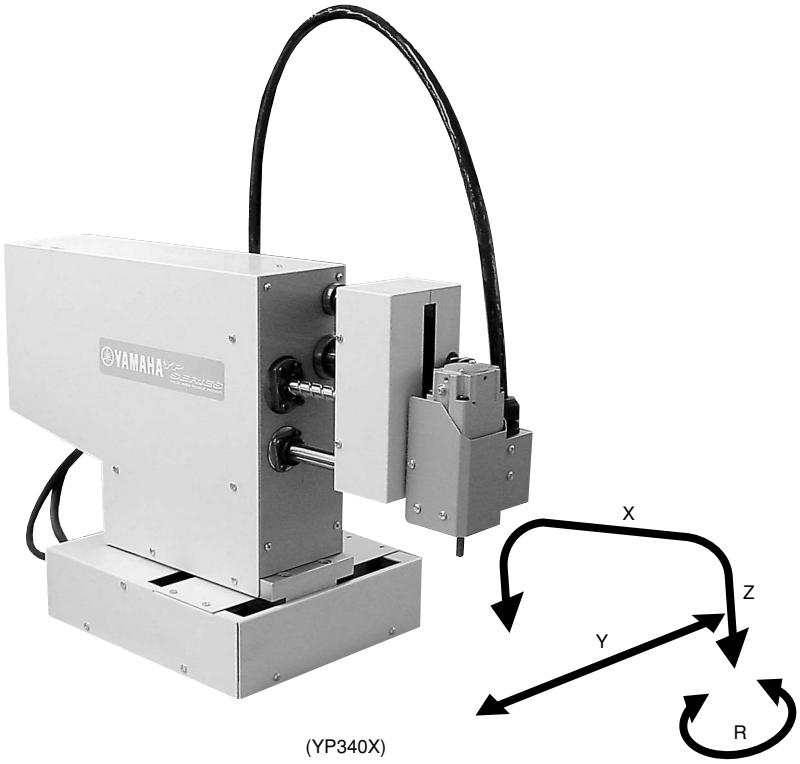
MEMO

1 P & P robot unit

The YP320X and YP220BX each have 2 axes: X and Z. The YP330X has 3 axes: X, Y and Z. The YP320XR and YP220BXR have 3 axes: X, Z and R. The YP340X has 4 axes: X, Y, Z and R. They move along the axes as shown in Fig. 2-1 and by adding custom tools, can perform work over a wide range with high accuracy and speed. These robots are ideal for high speed pick and place operations using small parts.



(YP320X)



(YP340X)

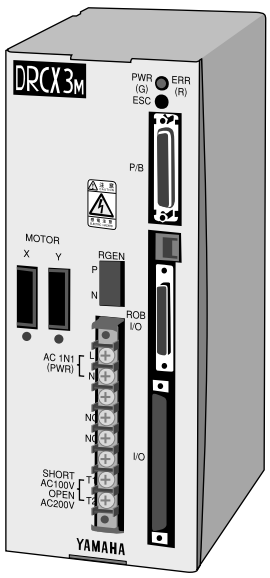
Fig. 2-1 P & P robots

2 P & P robot controller

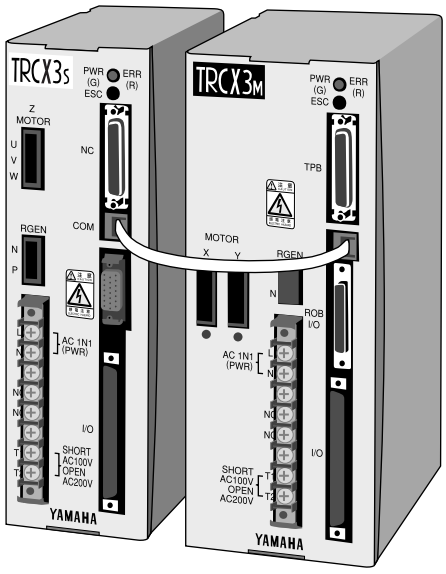
The YP-X series robots use the QRCX, TRCX, DRCX as their robot controllers. Please refer to the "YAMAHA Robot Controller QRCX, TRCX, DRCX Instruction and Owner's Manual" for detailed information on each robot controller.

NOTE

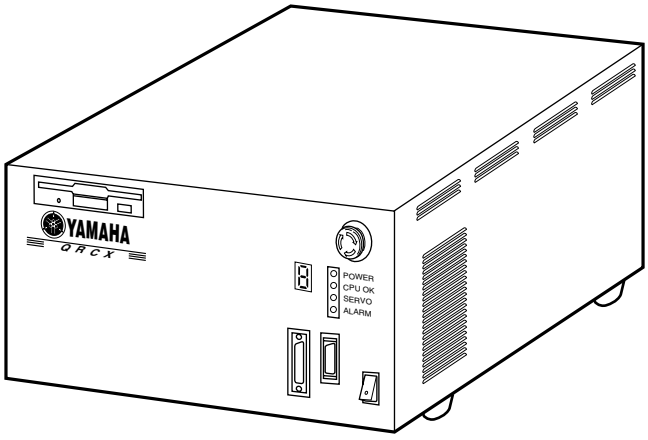
The “Y” displayed on the programming unit of the YP320X and YP220BX refers to the robot main unit axis (vertical movement). If data is input to “Y”, the Z axis will move.
Likewise, on the YP320XR and YP220BXR, the “Y” displayed on the programming unit is the Z-axis (up/down operation) of the robot unit, and the “Z” is the R-axis (swivel operation) of the robot unit.



DRCX



TRCX



QRCX

Fig. 2-2 Robot controllers

CHAPTER 3

Installation

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2 Installation 3-3

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3 Connection of robot cables 3-7

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MEMO

1 Robot Installation Conditions

1-1 Installation environments

Be sure to install the robot in the following environments.

Items	Specifications
Allowable ambient temperature	0 to 40°C
Allowable ambient humidity	35 to 85% RH (non condensation)
Height	0 to 1000 meters above sea level
Ambient environments	Avoid installing near water, cutting water, oil, dust, metallic chips and organic solvent.
	Avoid installation near corrosive gas and corrosive materials.
	Avoid installation in atmosphere containing inflammable gas, dust and liquid.
	Avoid installation near objects causing electromagnetic interference, electrostatic discharge and radio frequency interference.
Vibration	Do not subject to impacts or vibrations.
Air supply pressure, etc.	Below 0.58MPa (6.0kgf/cm^2); clean dry air not containing deteriorated compressor oil; filtration 40μm or less
Working space	Allow sufficient space margin to perform jobs (teaching, inspection, repair, etc.)

For detailed information on how to install the robot controller, refer to the separate "YAMAHA Robot Controller Owner's Manual".

⚠ WARNING

Avoid installing the robot in locations where the ambient conditions may exceed the allowable temperature or humidity, or in environments where water, corrosive gases, metallic powder or dust are generated. Malfunction, failure or short circuits may otherwise result.

⚠ WARNING

- **This robot was not designed for operation in environments where inflammable or explosive substances are present.**
- **Do not use the robot in environments containing inflammable gas, dust or liquids. Explosions or fire could otherwise result.**

⚠ WARNING

Avoid using the robot in locations subject to electromagnetic interference, electrostatic discharge or radio frequency interference. Malfunction may otherwise occur.

⚠ WARNING

Do not use the robot in locations subject to excessive vibration. Robot installation bolts may otherwise become loose causing the manipulator to fall over.

2 Installation

Strictly observe all safety precautions and procedures inorder to install the robot correctly and safely.

2-1 Installation frame

1) Prepare a strong, rigid installation frame to absorb large reactive forces that occur during robot operation.

⚠CAUTION

Vibration (resonance) may adversely affect robot operation if this frame is not rigid.

2) The levelness and parallelism of the robot installation surface on the frame must be manufactured to within a precision of ±0.1mm or more.

⚠CAUTION

If the installation surface (level) precision is deficient the robot will have poor positioning precision.
Strictly observe all safety precautions and procedures to ensure the robot is installed safely and correctly.

2-2 Installing the robot

(1) YP320X, YP320XR installation
Eight M8 screw holes (pitch 1.25 mm) are provided in the base section of the YP320X and YP320XR unit. Use four of these holes for the installation.

⚠CAUTION

The plate thickness of the base is 20 mm so make sure the bolts do not exceed this distance and protrude into the robot interior.

1) Drill holes (approx. 10 dia.) into the frame installation surface as shown.

2) Tighten with hex head bolts from the rear side of the frame through the holes. The M8 bolt tightening torque is 230 to 370 kgcm.

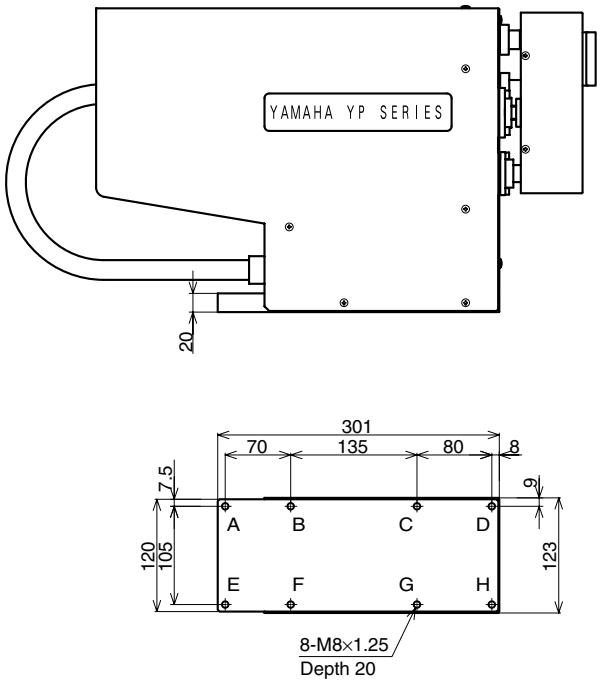


Fig. 3-1 YP320X, YP320XR installation

Installation to the frame can also be done by removing the unit cover and installing four M6 bolts from the robot side into A, C, E and G as shown in Fig. 3-1 into the frame.
The M6 bolt tightening torque is 100 to 160 kgcm.
The D and H holes are not used at this time.

⚠WARNING

Be sure to use the specified type and number of bolts, and securely tighten them to the correct torque. If the bolts are not tightened correctly, the robot may cause positioning errors or fall over during operation, causing a serious accident.

(2) YP330X, YP340X installation

Eight M8 screw holes (pitch 1.25 mm) are provided in the base section of the YP330X and YP340X units. Use four of these holes for the installation.

⚠CAUTION

The plate thickness of the base is 20 mm so make sure the bolts do not exceed this distance and protrude into the robot interior.

1) Drill holes (approx. 10 dia.) into the frame installation surface as shown.

2) Tighten with a hex head bolts from the rear side of the frame through the holes.

The M8 bolt tightening torque is 230 to 370 kgcm.

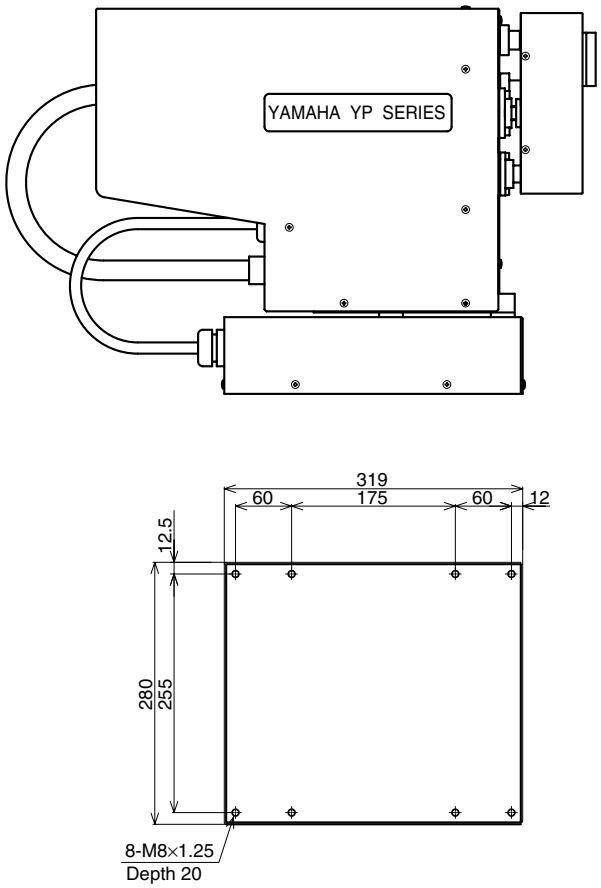


Fig. 3-2 YP330X, YP340X installation

⚠WARNING

Be sure to use the specified type and number of bolts, and securely tighten them to the correct torque. If the bolts are not tightened correctly, the robot may cause positioning errors or fall over during operation, causing a serious accident.

(3) YP220BX, YP220BXR

Four through-holes of 10mm diameter are provided on the bottom plate of the YP220BX and YP220BXR robots. Use these through-holes and M8 bolts when installing these robots.

1) Tap four M8 (thread pitch 1.25mm) holes into the installation base.

2) Secure the robot to the base with M8 hex socket head bolts (tightening torque: 230 to 370kgcm) from inside of the robot frame.

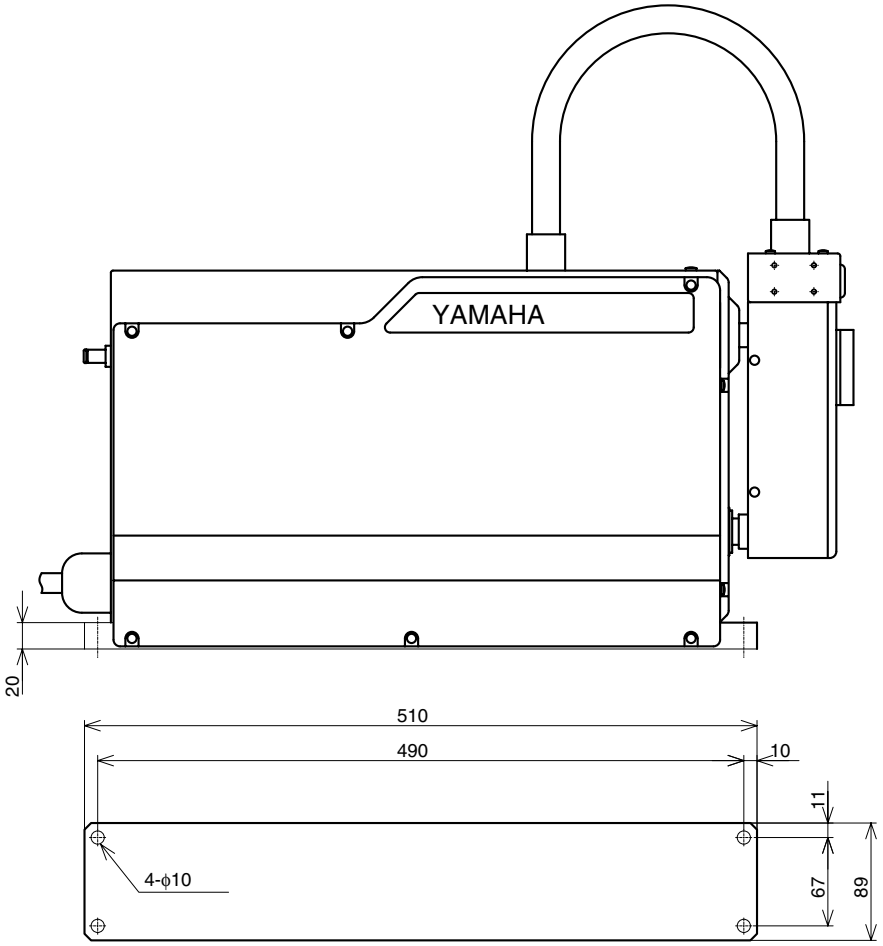


Fig. 3-3 YP220BX, YP220BXR installation

⚠ WARNING

Be sure to use the specified type and number of bolts, and securely tighten them to the correct torque. If the bolts are not tightened correctly, the robot may cause positioning errors or fall over during operation, causing a serious accident.

3 Connection of robot cables

The robot cables are already attached to the YP-X series robot side.
Refer to the "YAMAHA Robot Controller DRCX, TRCX or QRCX Instruction and Owner's Manuals" for connecting to the controller side.

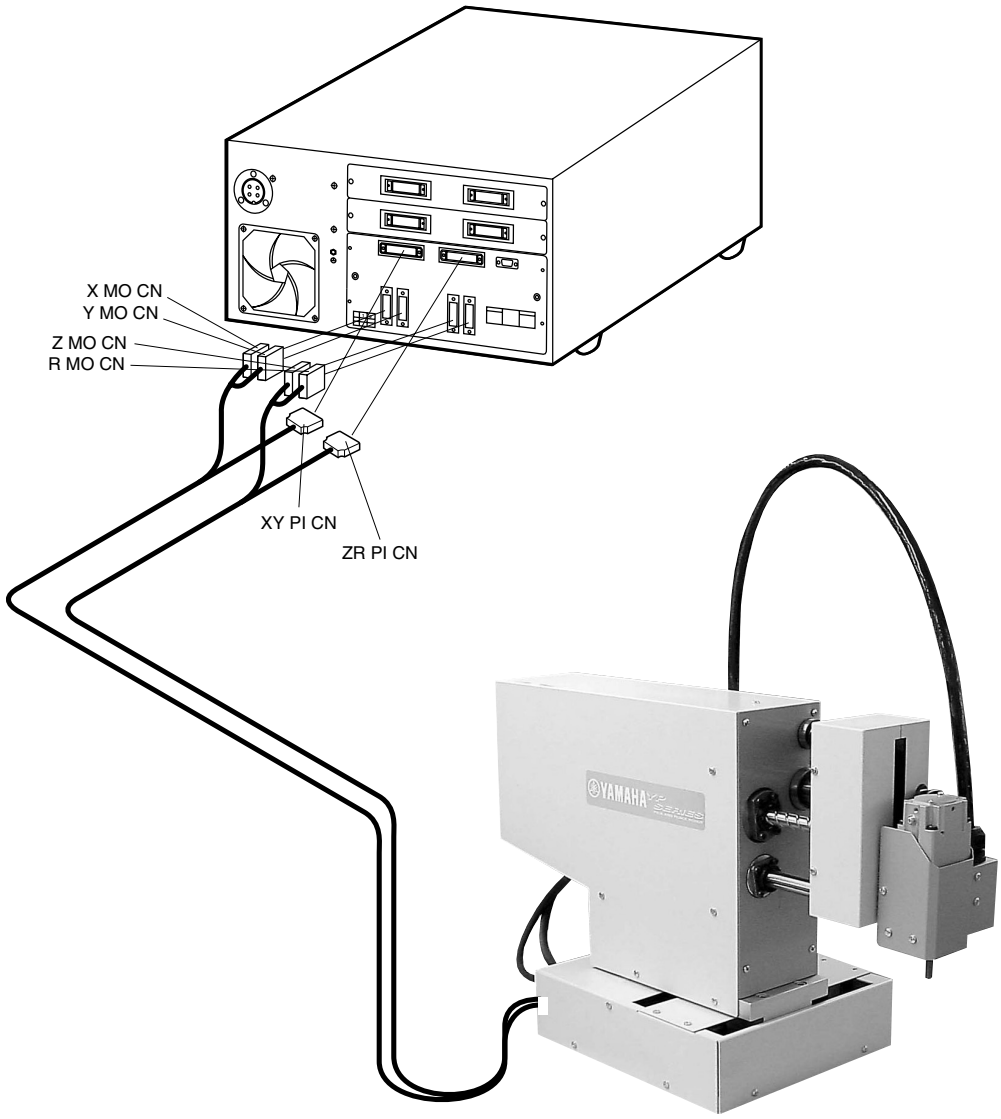


Fig. 3-4 Robot cable connections

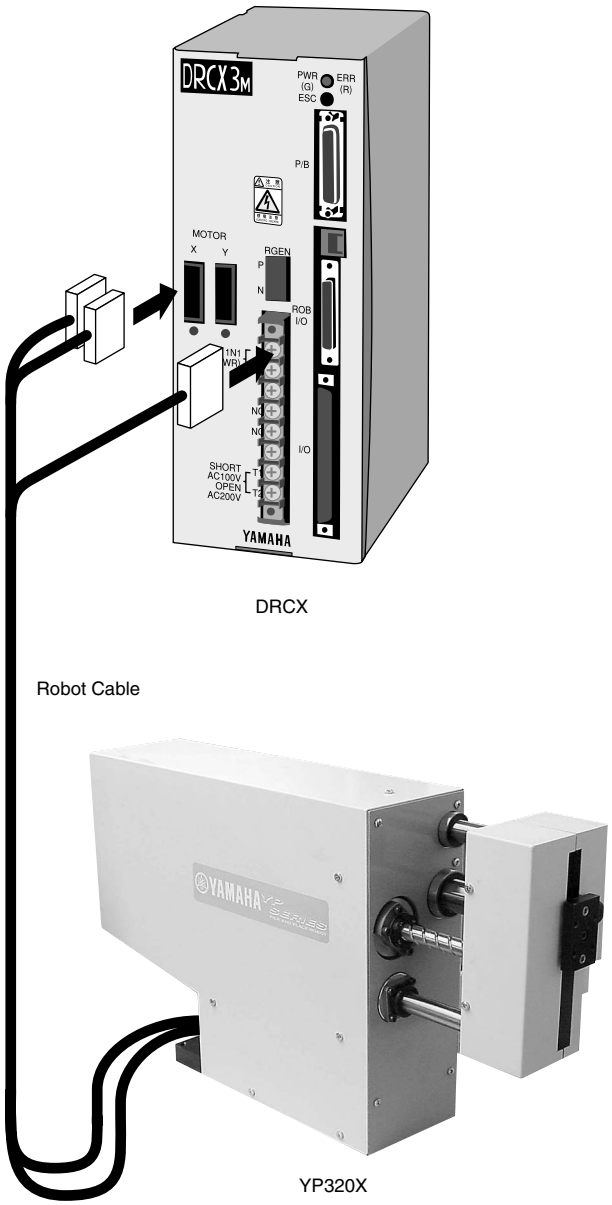


Fig. 3-5 Robot cable connections

4 Protective Bonding

⚠WARNING

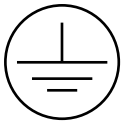
Be sure to ground the robot and controller to prevent electrical shock.

⚠WARNING

Turn off the controller before grounding the robot.

The robot must be grounded as follows:

1) Provide a terminal marked "PE" for the protective conductor of the entire system and connect it to an external protective conductor. In addition, securely connect the ground terminal on the robot to the same protective conductor.



(Symbol 417-IEC-5019)

2) The Z-axis ground terminal can also be used when the end effector uses an electrical device which, if it malfunctions, might make contact with the power supply. To check the ground terminal locations, refer to Chapter 6, "Specifications".

3) For details on protective bonding on the robot body to comply with CE markings, follow the instructions on protective bonding explained in the YAMAHA Robot Controller Owner's Manual.

⚠CAUTION

- **Use a ground cable thicker than the AWG14 (2.0mm^2) wire.**

⚠ WARNING

- **Before connecting the cables, check that there are no bends or breaks in the connector pins of the robot cable and that the cables are not damaged. Bent or broken pins or cable damage may cause malfunction of the robot.**
- **Ensure that the controller is off before connecting the robot cable to the controller.**

⚠ WARNING

In the QRCX controllers, the MOTOR connectors XM and ZM, and YM and RM each have identical shapes. In addition, the PI connectors XY and ZR have identical shapes. Do not confuse these connectors when making connections. Wrong connections may result in malfunction and hazardous situations.

⚠ WARNING

- **If the connector installation is inadequate or if there are contact failures in the pins, the robot may malfunction causing a hazardous situation. Reconfirm that each connector is securely installed before turning on the controller.**
- **To attach the PI connector securely, tighten the screws supplied with the robot.**
- **Take caution not to apply an excessive load to the connectors due to stress or tension on the cables.**

⚠ WARNING

Lay out the cables so that they do not obstruct the movement of the manipulator. Determine the robot work area in which the robot cables will not interfere with the load or workpiece picked up by the manipulator. If the robot cables interfere with the movable parts of the robot, the cables may be damaged causing malfunction and hazardous situations.

⚠ WARNING

Lay out the robot cables so as to keep the operator or any other person from tripping on them. Bodily injury may result if someone trips on the cables.

CHAPTER 4

Adjustment

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2 Setting the origin position 4-3

2-1 Mark method (R-axis) 4-4

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3-1 Adjustment of X,Y, Z axis motor belt tension 4-6

3-2 Adjustment of Z axis tip belt tension (YP320X, YP320XR, YP330X, YP340X) 4-7

3-3 Adjustment of Z axis tip belt tension (YP220BX, YP220BXR) 4-8

3-4 Adjust the X-axis belt tension (YP220BX, YP220BXR) 4-9

MEMO

1 Outline

Various adjustments, including the origin adjustment, have been completely performed by YAMAHA or the dealer at shipment. If the usage conditions are changed (changes of tools such as the hand) and the P & P robot must be adjusted for this, follow the procedure given in this chapter.

⚠ DANGER

- **If the adjustment or maintenance procedure calls for operation of the robot, stay out of the working area of the manipulator while it is operating. Do not touch any parts inside the controller. Keep watching the manipulator movement and surrounding area so that the operator can press the emergency stop button if any danger occurs.**

⚠ WARNING

- **When the robot does not need to be operated during adjustment or maintenance, always turn off the controller and the external power distribution panel.**
- **Do not touch the internal parts of the controller for several seconds after the power to the controller has been turned off.**
- **When performing electrical maintenance which does not require manipulator movement, keep the emergency stop button pressed.**
- **When adjustment or maintenance is complete, retighten the bolts or screws securely.**
- **During robot adjustment or maintenance, place a sign indicating that the robot is being adjusted or inspected, to prevent other persons from inadvertently touching the control keys or switches. Provide a lock on the switch keys or ask someone to keep watch as needed.**

1-1 Robot parameter settings

Please take note of the following points when setting parameter data on the robots. (Refer to the DRCX, TRCX or QRCX controller instruction manual.)

- Do not set the plus and minus software limits larger than the default settings (operating range as listed in the specifications). This could cause the axis to strike the mechanical stopper and upset the alignment.

- Always be sure to make the payload settings. Failing to make these settings or making the wrong settings could cause early equipment breakdowns. (Typical setting: Set a figure of 2kg, when the total weight of tool + work is 1.4kg.)

- The direction of origin return cannot be changed during absolute reset. Using stroke-end origin detection method on the side opposite the standard side could cause equipment breakdowns.

2 Setting the origin position

All models of the YP-X series use a position detector for absolute reset. The origin position ("0" pulse position) is set by performing absolute reset. Once absolute reset is performed, it is not needed when the power is turned on again. However, absolute reset is required in the following cases. Be especially sure to perform absolute reset for the case of "c" below when the robot has been shipped from the factory.
Refer to the YAMAHA robot controller Instruction manual for detailed information on performing absolute reset.
Perform absolute reset …

a. When an error involving the absolute limit occurred on an axis.
b. When a low battery (voltage) was detected in the battery for the driver installed inside the controller.
c. When the controller and robot cable were removed. (The robot is shipped in this state.)
d. When a change was made in the robot generation.
e. When the parameters were initialized.
f. When a change was made to a parameter relating to the origin return method, origin return direction, axis polarity or origin shift.
g. When the motor was replaced (when motor cable connector was removed)
h. When the parameter data or all the data was sent to the controller via the RS-232C.

The method for performing absolute reset is shown in this chapter.

⚠CAUTION

After installing the robot, absolute reset must be performed again in the case of "a" through "h" above. The robot must be moved to the origin position before absolute reset can be performed. After the robot setup is complete, select an origin position that will not interfere with the peripheral equipment.

⚠CAUTION

After performing absolute reset, move the robot to a point already known and verify that the origin position was set correctly.
In such cases, keep the robot movement at low speed, as much as possible.

⚠CAUTION

The point data must be set again when the origin position was changed.

⚠CAUTION

If the origin position was changed, then you must make new point data.
Do not attempt to use point data that was made before the origin position was changed.

The mark method or the stroke end method can be used to perform absolute reset for the YP-X series. The mark method is used for the R-axis default setting and the stroke end method is used for the X, Y and Z axis default settings.

2-1 Mark method (R-axis)

In the mark method, the robot is moved beforehand to the position where you want to perform absolute reset. That position will be the absolute reset position.

(1) Move the robot in jog mode while in servo-on.

(2) Move the robot manually while in servo-off.

⚠CAUTION

Absolute reset by the mark method is also possible by using a teaching pendant or data sent through an RS-232C. However, absolute reset is not possible with custom inputs.

⚠CAUTION

The YP320XR, YP340X and YP220BXR come supplied with alignment mark seals for the R-axis. Perform absolute reset by the mark method, and then attach these seals (or stickers) after finding the origin position. If you attach the seal as far away from the center of rotation as possible, then the repeatability is higher when the next time absolute reset is needed. (See Fig. 4-1.)

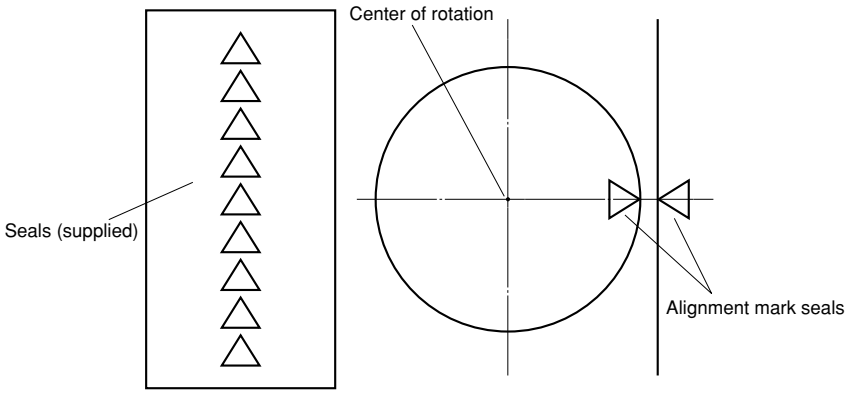

Fig. 4-1 Seals supplied with robot

2-2 Stroke end method (X, Z, Y axes)

In absolute reset by the stroke end method, the position where the axis tip strikes the mechanical stopper is detected, and absolute reset performed at a position backed off slightly from the stroke end.

⚠ WARNING

Making physical contact with the robot during operation can cause severe injuries.
Never enter within the movement range of the robot during absolute reset.

⚠ CAUTION

The stroke end method is used for the X, Z and Y axes.
An ideal position to end absolute reset is approximately 4 to 5mm away from the mechanical stopper. If the position obtained is not 4 to 5mm away, then change the position where the belt teeth engage the pulley and try performing absolute reset again.

3 Adjustment of the belt tension

Each axis of the YP-X series robots has a belt-driven structure. When this belt is replaced or when it is stretched due to strong external forces (bumping etc.), adjust the belt tension with the following procedure.

3-1 Adjustment of X,Y, Z axis motor belt tension

1) Turn off the controller power.
2) Remove the cover for each axis.
3) Loosen the bolts securing each motor and apply tension to the belt by pulling on the motor. When loads as shown in the table below are applied to the center section of the belt, a slack amount as shown in the lower part of the table is satisfactory.
4) Retighten the bolts securing the motor and reinstall the axis covers.

Robot Model	YP320X YP320XR		YP330X YP340X			YP220BX YP220BXR	
	X-axis	Z-axis	X-axis	Y-axis	Z-axis	X-axis	Z-axis
Load (Kg)	1	0.5	1	1	0.5	0.5	0.5
Slack (mm)	1	1	1	2	1	1	1

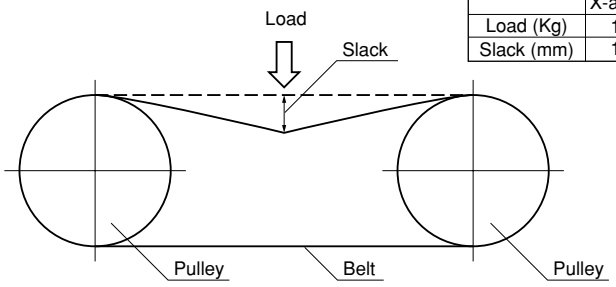

Fig. 4-2 Belt tension

⚠CAUTION

Belt tension that is too strong will damage the motor shaft.

⚠CAUTION

The robot position may change depending on the belt tension.

3-2 Adjustment of Z axis tip belt tension (YP320X, YP320XR, YP330X, YP340X)

1) Turn off the controller power.
2) Remove the robot Z axis cover.
3) Loosen the bolt securing the belt tensioner as shown in Fig. 4-3 and loosen the belt.
4) Insert a slotted screwdriver into the clearance between the X axis plate and the belt tensioner, and then lever the screwdriver to apply tension to the belt.
5) Apply a load of 0.5 kgf to the center section of the belt for fixing the belt tension. A slack of approximately 2mm is satisfactory.
6) If the belt tension in now satisfactory, tighten the bolts securing the belt tensioner.
7) Install the Z axis cover for the robot.

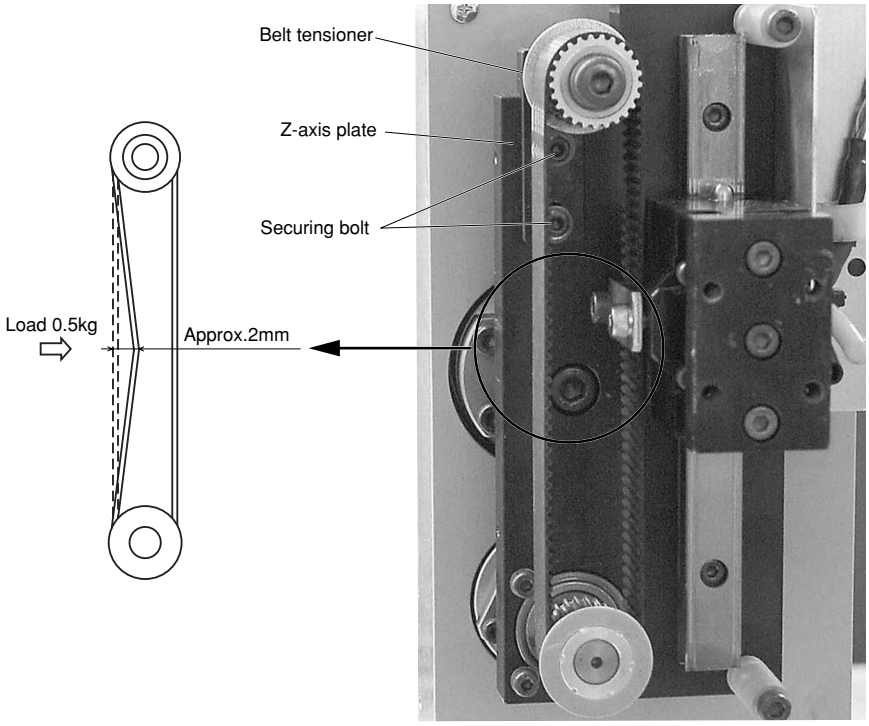

Fig. 4-3 Belt tension

3-3 Adjustment of Z axis tip belt tension (YP220BX, YP220BXR)

1) Turn off the controller power.
2) Remove the robot Z axis cover.
3) Loosen the bolt securing the belt tensioner as shown in Fig. 4-4 and loosen the belt.
4) Screw the M6 bolt into the hole located beneath the belt tensioner (L-shaped metal plate) to apply tension to the belt.
5) Apply a load of 0.5 kgf to the center section of the belt for fixing the belt tension. A slack of approximately 2mm is satisfactory.
6) If the belt tension in now satisfactory, tighten the bolts securing the belt tensioner.
7) Install the Z axis cover for the robot.

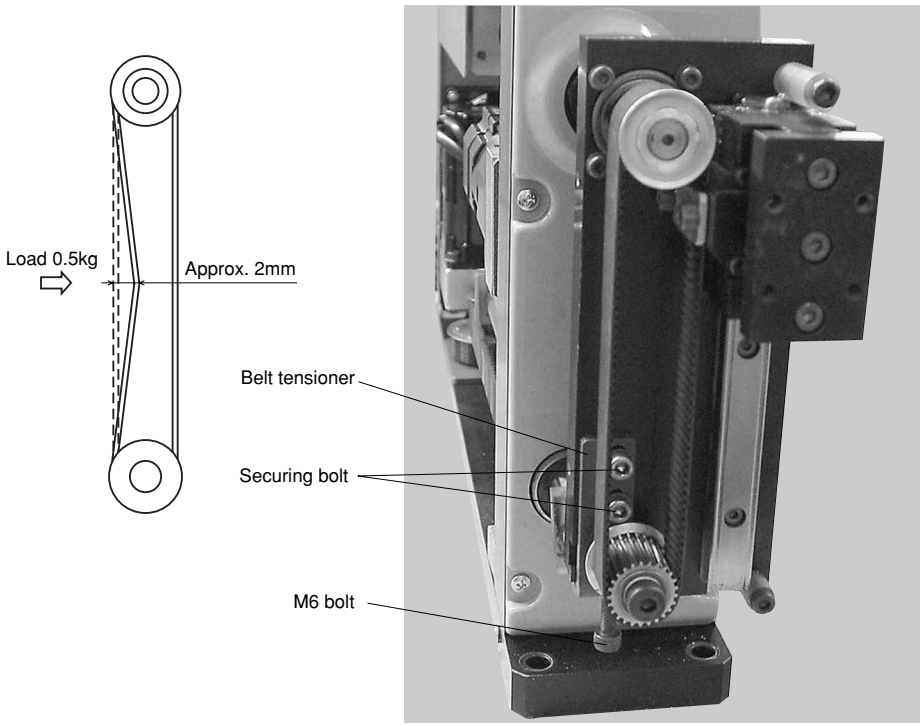

Fig. 4-4 Belt tension

3-4 Adjust the X-axis belt tension (YP220BX, YP220BXR)

1) Turn off the controller power.
2) Remove the side cover on the robot unit.
3) Loosen the bolts securing the driven pulley shown in Fig. 4-5.
4) Loosen the belt tensioner (L-shaped metal plate) M5 bolts and apply tension to the belt.
5) As a guide for setting belt tension, check a slack in the belt of about 5mm when a 1kg load is applied to the center of the belt.
6) If the belt tension in now satisfactory, tighten the bolts securing the belt tensioner.
7) Reattach the side cover on the robot unit.

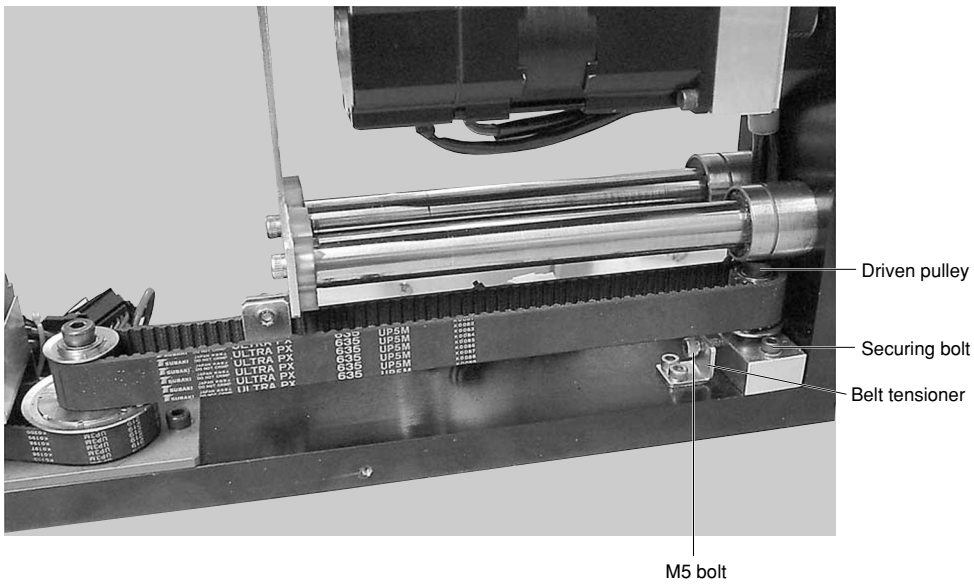

Fig. 4-5 Belt tension

MEMO

CHAPTER 5

Periodic Inspecition

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MEMO

1 Introduction

Periodic inspections and maintenance are extremely important in assuring that the YAMAHA robot will perform safely and efficiently. This chapter covers the procedures by which periodic inspections of the YAMAHA YP-X Series are carried out, as well as the items to be inspected and information on maintenance.

⚠ DANGER

• If the adjustment or maintenance procedure calls for operation of the robot, stay out of the working area of the manipulator while it is operating. Do not touch any parts inside the controller. Keep watching the manipulator movement and surrounding area so that the operator can press the emergency stop button if any danger occurs.

⚠ WARNING

- **When the robot does not need to be operated during adjustment or maintenance, always turn off the controller and the external switch board.**
- **Do not touch the internal parts of the controller for several seconds after the power to the controller has been turned off.**
- **When performing electrical maintenance which does not require manipulator movement, keep the emergency stop button pressed.**
- **Use only the lubricants or grease specified by YAMAHA or the YAMAHA sales dealer.**
- **Use only the parts specified by YAMAHA or the YAMAHA sales dealer. Take sufficient care not to allow any foreign matter to contaminate them during adjustment, parts replacement or reassembly.**
- **Do not alter any part of the manipulator or controller. Doing so may result in unsatisfactory specifications or may threaten the safety of the operator.**
- **When adjustment or maintenance is complete, retighten the bolts and screws securely.**
- **During robot adjustment or maintenance, place a sign indicating that the robot is being adjusted or inspected, to prevent other persons from inadvertently touching the control keys or switches. Provide a lock on the switch keys or ask someone to keep watch as needed.**

⚠ WARNING

Precautions when handling grease:

- **Inflammation may occur if they get in the eyes.**
  Before handling them, wear your safety goggles to ensure they will not come in contact with the eyes.
- **Inflammation may occur if they come into contact with skin. Be sure to wear protective gloves to prevent contact with skin.**
- **Do not take orally or eat. (Eating will cause diarrhea and vomiting.)**
- **Hands and fingers might be cut when opening the container, so use protective gloves.**
- **Keep out of the reach of children.**
- **Do not heat them or place near an open flame since this could lead to sparks and fires.**

Emergency Treatment:

- **If they get in the eyes, wash liberally with pure water for about 15 minutes and consult a physician for treatment.**
- **If they come in contact with the skin, wash away completely with soap and water.**
- **If taken internally, do not induce vomiting but promptly consult a physician for treatment.**

2 Inspection

2-1 Daily Checklist

The following is a list of maintenance operations that must be performed every day before and after operating the robot.

CHECK POINT	PROCEDURE
Cables	Check for scratches, dents, holes and kinks.
Motor, Encoder, Deceleration, Ball screw, Bearing	Check for excessive vibration, noise and, overheating, etc. Remove all dirt and dust, and apply a thin coat of grease.
(X axis) Ball screw, ball spline, ball bush section (Y, Z axes) Linear guide section	Use Alvania No. 2 (Showa Shell) or Daphney Kuronex (Idemitsu Kosan) grease. * Maintain the parts so that they never dry out.

⚠CAUTION

Avoid using the sliding parts such as ball screws, ball splines, ball bushings and linear guides while they are in a dry state. A premature wear or damage to the sliding surface may otherwise result.

⚠CAUTION

Using a grease other than recommended by YAMAHA may shorten the service life of the ball screw, ball spline, ball bushing and linear guide.

2-2 Six Month Inspection

Inspect the following for the six month inspection, and replace parts if necessary.

Inspection or replacement place	Inspection or replacement details
Main bolts and screws on the P & P robot	Check for looseness. If loose, tighten.
X, Y and Z axis timing belt	Check the X, Y, and Z axis timing belts for tension, scratches and wear.
Machine reference after absolute reset	Perform absolute reset and check that the machine reference is within the specified range (45 to 55%).
Wiring in P & P robot	• Check for scratches on the cables, etc. • Check for looseness in the relay connectors, etc.
Inside controller	• Check that the relay contact point operates properly • Check for looseness in the terminals • Check for looseness in the connectors
Fan for air-cooling on rear of controller	• Check that the fan rotates • Check for abnormal sounds during rotation • Check for dirt on the fan cover. Remove and clean if dirty.

3 Replacement of Motor

Replace the motor if it generates abnormal sounds or vibrations, causes errors or cannot be positioned correctly.

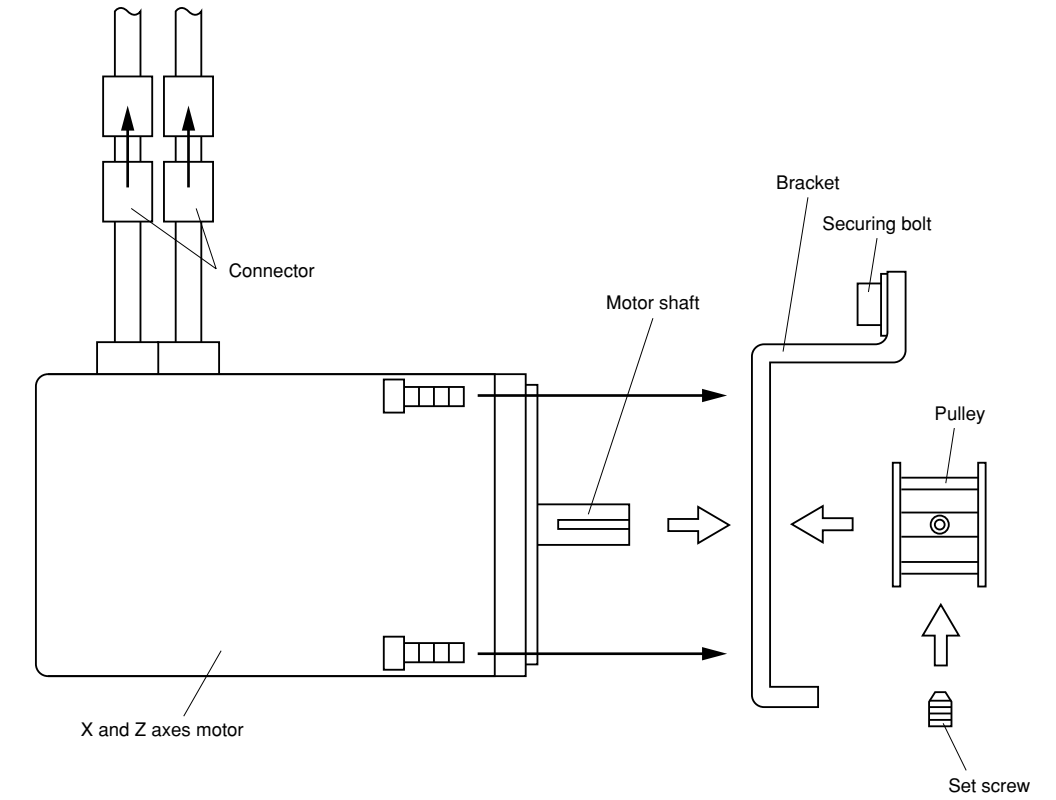
⚠CAUTION

After the motor has been replaced, the origin position must be set again by absolute reset, point data setting rechecked, and belt tension readjusted

3-1 Replacement of X, Y, Z axis motors (YP320X, YP330X, YP340X, YP320XR)

The X axis motors for the YP320X, YP330X, YP340X, YP320XR; and the Y axis motors for the YP330X, YP340X are all installed on brackets. The pulley installs onto the motor shaft with setscrews.

1) Turn off the controller power.
2) Remove each of the covers.
3) Disconnect the motor power cable and signal cable connectors.
4) Loosen the tautness of the belt, and remove the motor from the bracket. Make a note of how the motor is facing and the bracket position.
5) Remove the motor from the pulley.
6) Install the new motor using the above procedure in reverse. Coat the setscrews with Screwlock or equivalent.
7) Apply tension to the belt. It must not be too loose or too tight. (See Chapter 4.)
8) Perform absolute reset to set the origin position again. Adjust the belt teeth and pulley to their approximate positions relative to each other before replacement.
9) Reinstall each cover.
10) Make corrections if any of the point data has deviated.



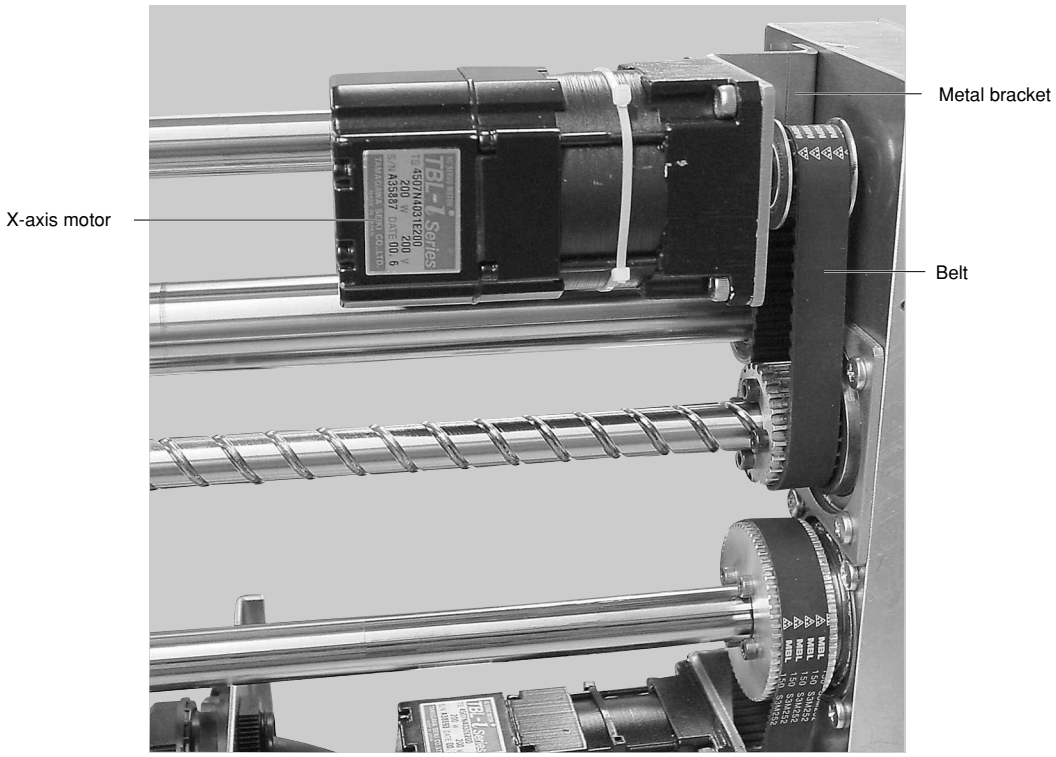


Fig. 5-1 Motor replacement

3-2 Replacement of X and Z axis motor (YP220BX, YP220BXR)

The X and Z axis motors of the YP220BX and YP220BXR are both attached to a metal bracket. A pulley is attached to the motor shaft by a setscrew.

1) Turn off the controller power.
2) Remove the side cover on the robot unit.
3) Disconnect the motor power cable and signal cable connectors.
4) Loosen the belt tension and remove the motor from the metal bracket. Make a note at this time, of the direction the motor faces and its position relative to the bracket.
5) Remove the bearing block placed between the metal bracket and the motor.
6) Remove the pulley from the motor. Using the pulley removal tap will make it easier to remove the pulley.
7) Install the new motor in the opposite of the order that the motor was just removed.
8) Apply tension to the belt. Make sure the belt is not too loose and not too tight. (See Chapter 4.)
9) Perform absolute reset to set the origin position again. Adjust the belt teeth and pulley to their approximate positions relative to each other before replacement.
10) Reattach the side cover on the robot unit.
11) Make corrections if any of the point data has deviated.

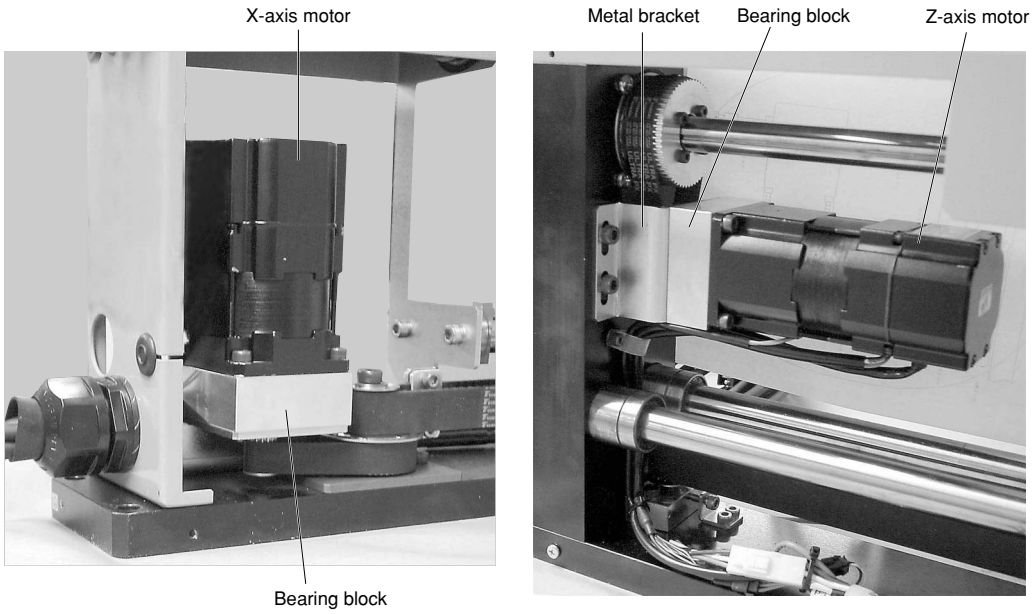


Fig. 5-2 motor replacement

3-3 Replacement of R axis motor (YP220BXR, YP320XR, YP340X)

The R-axis motor on the YP220BXR, YP320XR, YP340X is a built-in structure and basically comprised of a stator and rotor.

1) Turn off the controller power.
2) Remove the cover on which a R-axis whip-over cable is attached, and disconnect the motor power cable and signal cable connectors.
3) Remove the four M4 bolts securing the stator, and extract the stator upwards.
4) Remove the plate securing the rotor to the motor shaft. The plate is fastened with four M2.6 bolts.
5) Extract the rotor upwards, and replace with a new rotor.
6) Install the rotor and stator in the opposite order that the old parts were removed. Tighten the bolts alternately at the diagonal positions.
7) Reattach the motor connectors and reinstall the cover.
8) Set the origin position again by absolute reset.
9) Affix the alignment mark seals.
10) Make corrections if any of the point data has deviated.

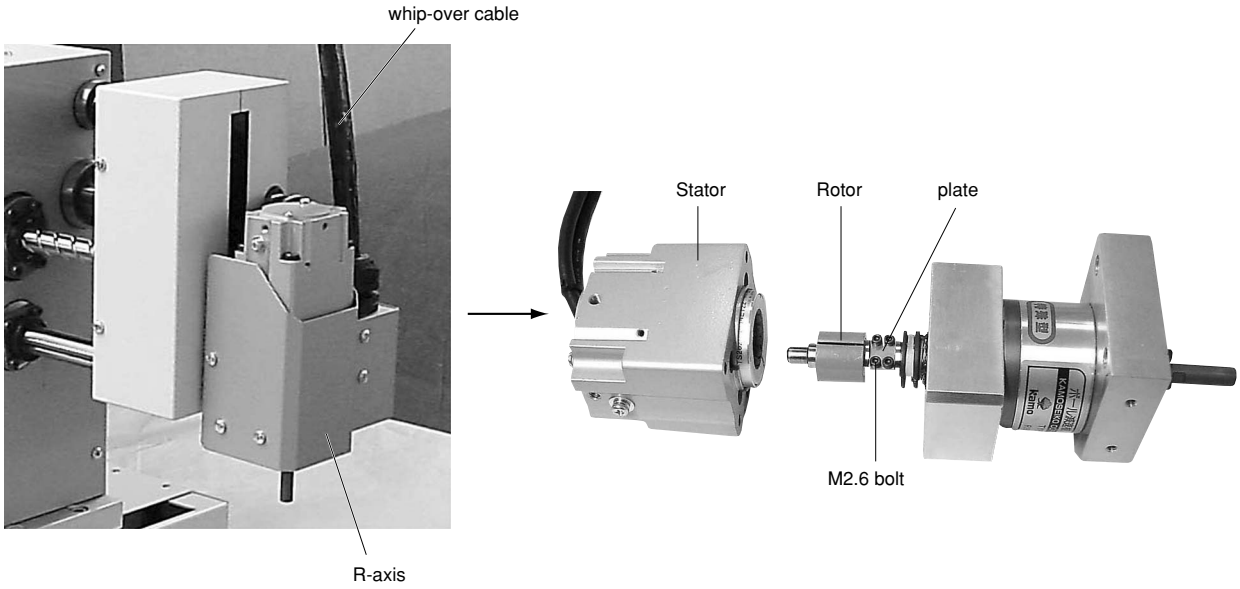


Fig.5-3 motor replacement

4 Belt replacement method

Replace the belt if it is damaged, worn or might otherwise interfere with machine operation.

⚠CAUTION

After the belt has been replaced, the origin position must be set again by absolute reset, point data setting rechecked, and belt tension readjusted.

4-1 Replacement of the X and Z axis belts (YP320X, YP330X, YP340X, YP320XR)

1) Turn off the controller power.
2) Remove each of the robot main unit covers.
3) Place marks(with a marker etc.) on the pulleys before replacement to limit deviations in point data occurring due to the belt replacement. (Fig. 5-4)
4) Loosen the M6 bolts securing the metal bracket for the X and Z axis motors.
5) Remove the M8 or M5 bolts shown in Fig. 5-5 and remove the plate securing each plate.
6) Remove the old belt and replace with the new belt.
7) Place the new belt on the pulley lining it up with the marks (for synchronizing the positions of the two pulleys) you made in step 3) above.
8) Adjust the belt tension and set the origin position again by absolute reset. (See Chapter 4.)
9) Make corrections if any point data has deviated.

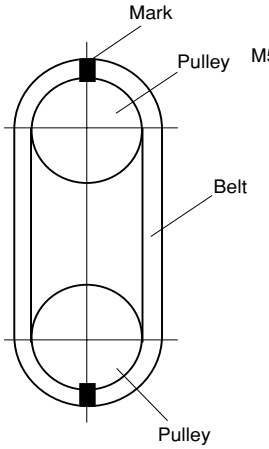


Fig. 5-4 Markings

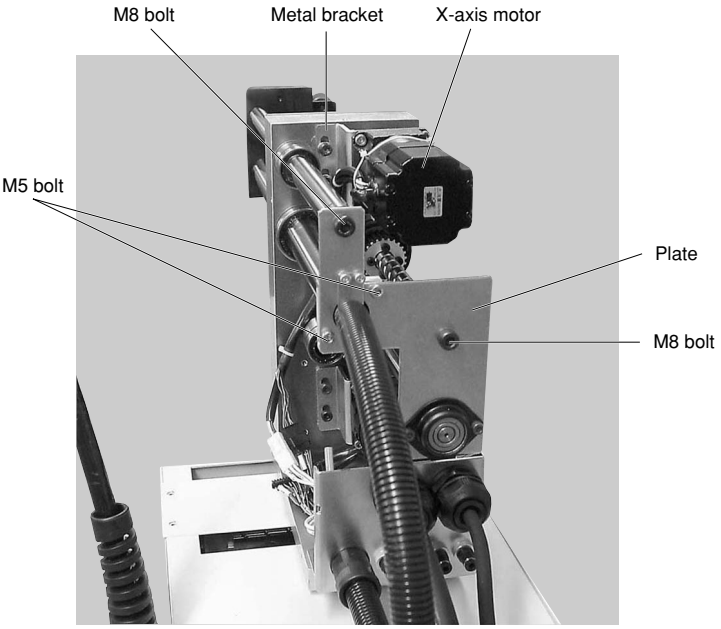


Fig. 5-5 Belt replacement

4-2 Replacement of Y axis belt (YP330X, YP340X)

1) Turn off the controller power.
2) Remove the robot Y axis cover.
3) Place marks(with a marker etc.) on the pulleys before replacement to limit deviations in point data occurring due to the belt replacement. (Fig. 5-4)
4) Loosen the tension on the belt and remove the belt.
5) Place the new belt on the pulley lining it up with the marks (for synchronizing the positions of the two pulleys) you made in step 3) above.
6) Adjust the belt tension and set the origin position again by absolute reset. (See Chapter 4.)
7) Make corrections if any point data has deviated.

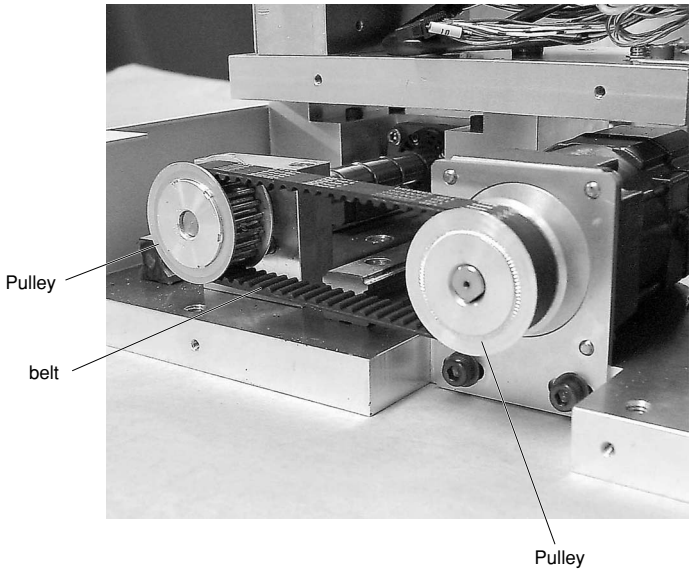


Fig. 5-6 Belt replacement

4-3 Replacement of Z axis belt (YP220BX, YP220BXR)

1) Turn off the controller power.
2) Remove the side cover on the robot unit.4)
3) Place marks(with a marker etc.) on the pulleys before replacement to limit deviations in point data occurring due to the belt replacement. (Fig. 5-4)
4) Remove the M6 bolts securing the Z-axis motor metal bracket, and remove the belt from the pulley.
5) Remove the M6 bolts shown in Fig. 5-8, and remove the plate securing each shaft.
6) Replace the old belts with new belts.
7) Place the new belt on the pulley lining it up with the marks (for synchronizing the positions of the two pulleys) you made in step 3) above.
8) Adjust the belt tension and set the origin position again by absolute reset.
9) Make corrections if any point data has deviated.

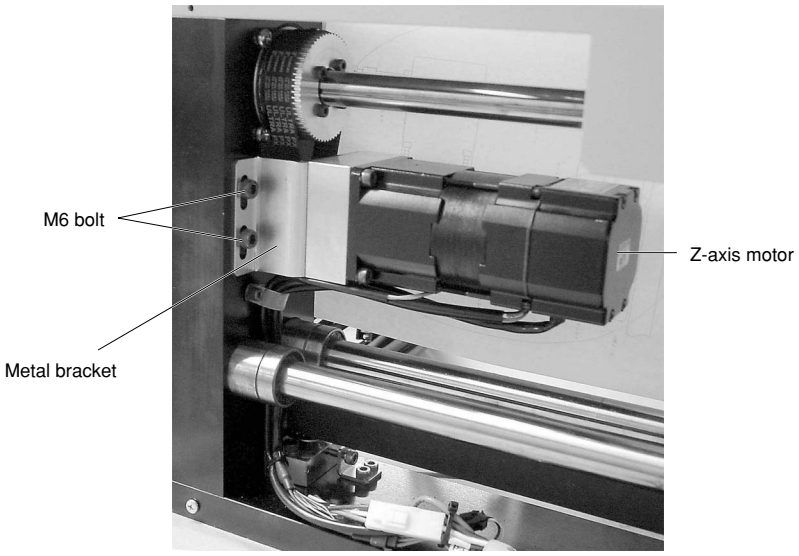


Fig. 5-7 Belt replacement

4-4 Replacement of X axis belt (YP220BX, YP220BXR)

1) Turn off the controller power.
2) Remove the side cover on the robot unit.4)
3) Place marks(with a marker etc.) on the pulleys before replacement to limit deviations in point data occurring due to the belt replacement. (Fig. 5-4)
4) Loosen the M6 bolts securing the X-axis motor metal bracket, and remove the belt from the pulley.
5) Loosen the bolt securing the driven pulley shown in Fig. 5-8.
6) Remove the M5 bolts securing the belt tensioner (L-shaped metal plate), and loosen the long belt tension (put slack in the belt).
7) The long belt is fastened to the plate with two M5 bolts so loosen these bolts and remove the belt.
8) After the long belt has been removed, remove the short belt.
9) Replace the old belts with new belts.
10) Place the new belt on the pulley lining it up with the marks (for synchronizing the positions of the two pulleys) you made in step 3) above.
11) Adjust the belt tension and set the origin position again by absolute reset.
12) Make corrections if any point data has deviated.

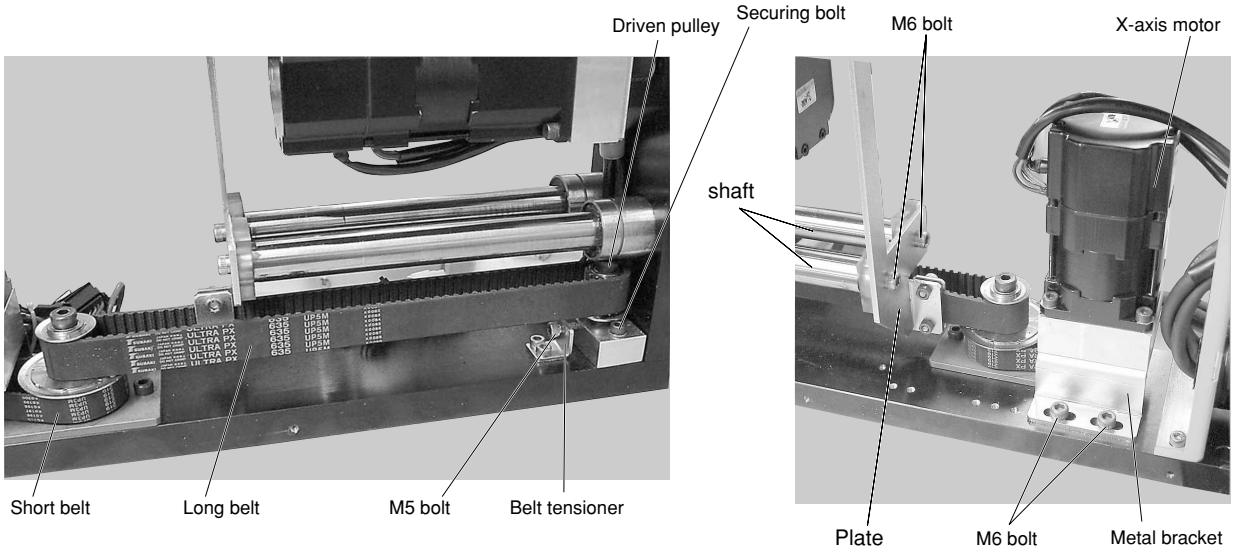


Fig. 5-8 Belt replacement

4-5 Replacement of Z axis tip section belt (YP320X, YP330X, YP340X, YP320XR)

1) Turn off the controller power.
2) Remove the robot Z axis cover.
3) Place marks(with a marker etc.) on the pulleys before replacement to limit deviations in point data occurring due to the belt replacement. (Fig. 5-4)
4) Remove the bolts securing the belt tensioner in Fig. 5-9 and remove the belt from the pulley.
5) Remove the plate gripping the belt in Fig. 5-9.
6) Prepare a new belt and grip the new belt with the plate removed in step 4). Apply a coating of Screw-lock (or equivalent) to the M5 bolts and tighten them.
7) Place the new belt on the pulley lining it up with the marks (for synchronizing the positions of the two pulleys) you made in step 3) above. Next install the belt tensioner.
8) Adjust the belt tension and set the origin position again by absolute reset as explained in the previous section. (See Chapter 4)
9) Make corrections if any point data has deviated.

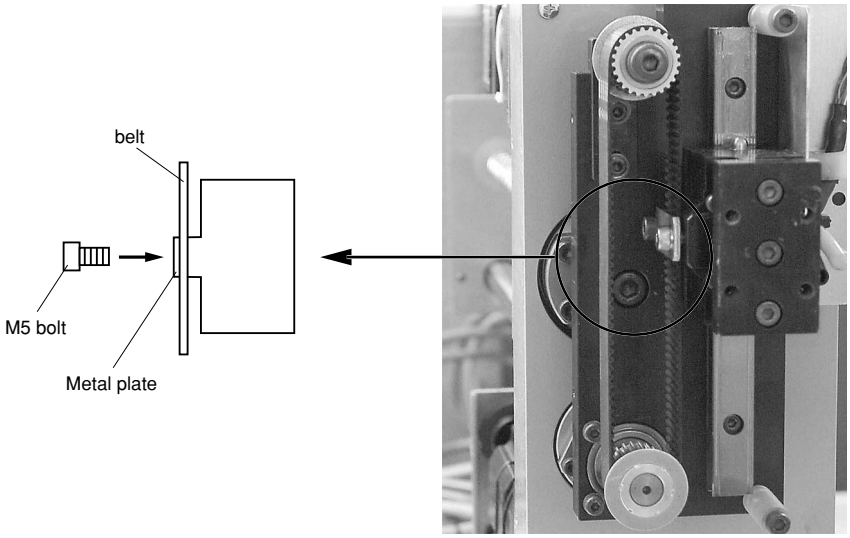


Fig. 5-9 Belt replacement

4-6 Replacement of Z axis tip section belt (YP220BX, YP220BXR)

1) Turn off the controller power.
2) Remove the robot Z axis cover.
3) Place marks(with a marker etc.) on the pulleys before replacement to limit deviations in point data occurring due to the belt replacement. (Fig. 5-4)
4) Remove the bolts securing the belt tensioner in Fig. 5-10 and remove the belt from the pulley.
5) Remove the plate gripping the belt in Fig. 5-10.
6) Prepare a new belt and grip the new belt with the plate removed in step 4). Apply a coating of Screw-lock (or equivalent) to the M5 bolts and tighten them.
7) Place the new belt on the pulley lining it up with the marks (for synchronizing the positions of the two pulleys) you made in step 3) above. Next install the belt tensioner.
8) Adjust the belt tension and set the origin position again by absolute reset as explained in the previous section. (See Chapter 4)
9) Make corrections if any point data has deviated.

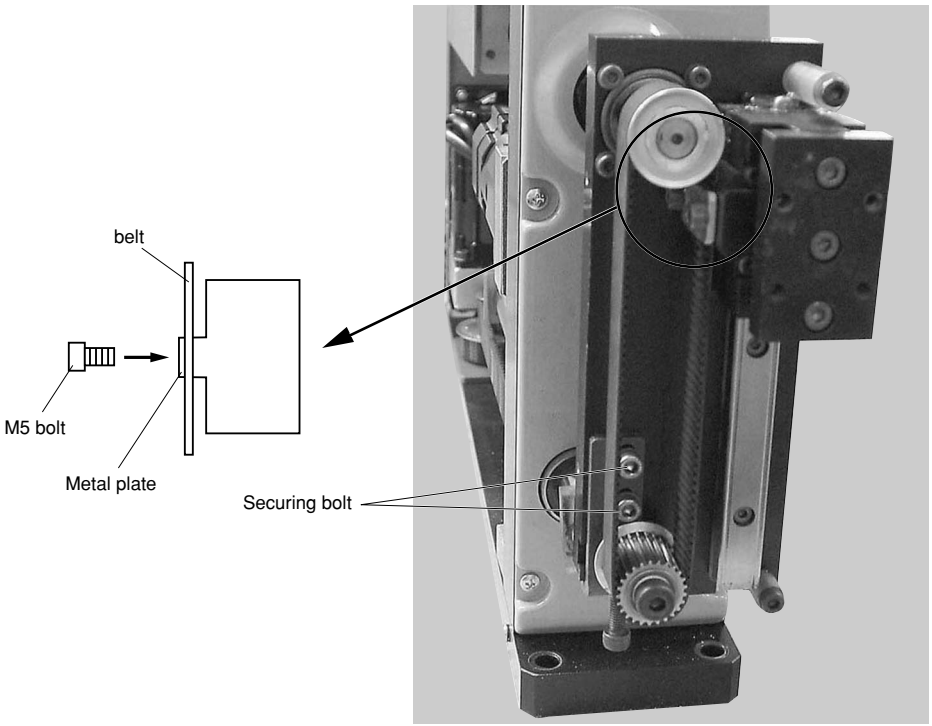
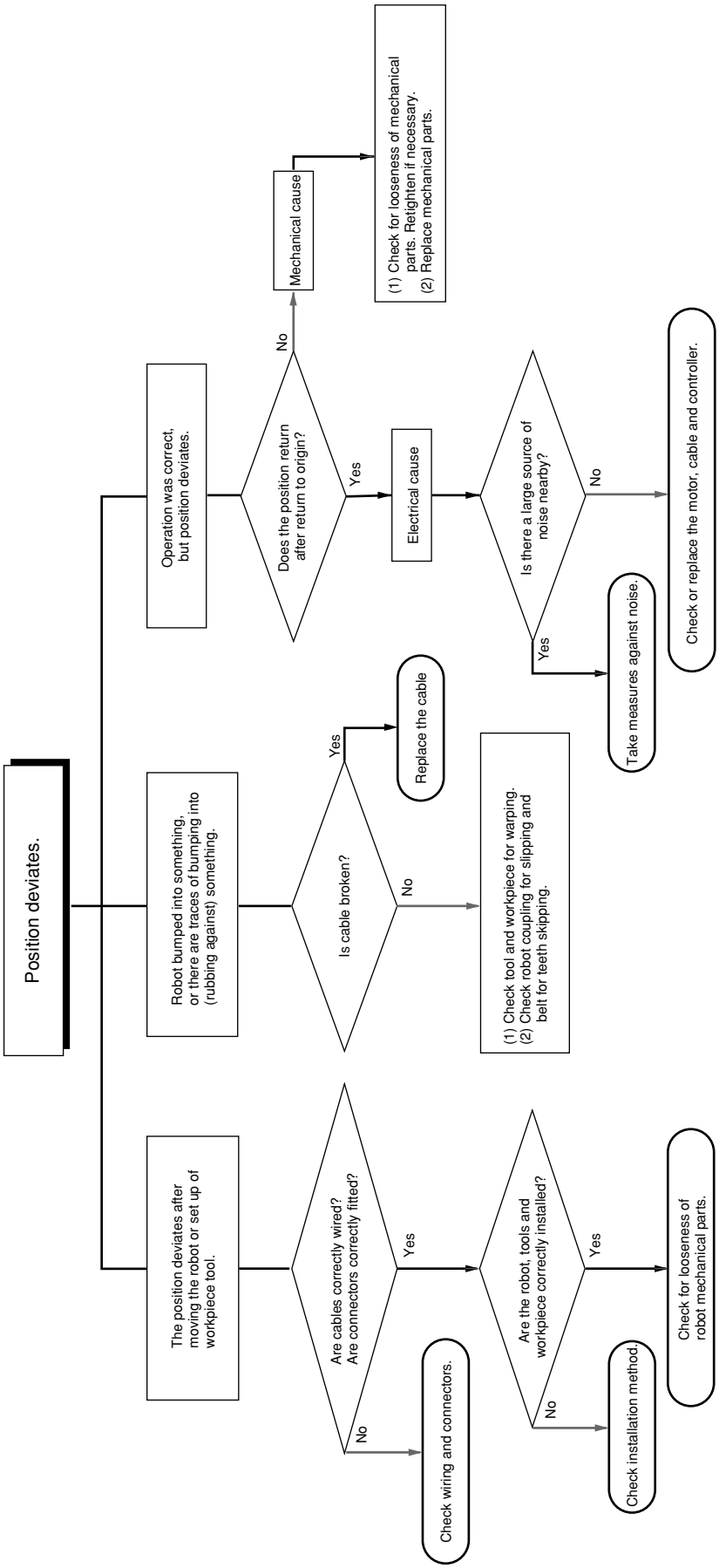
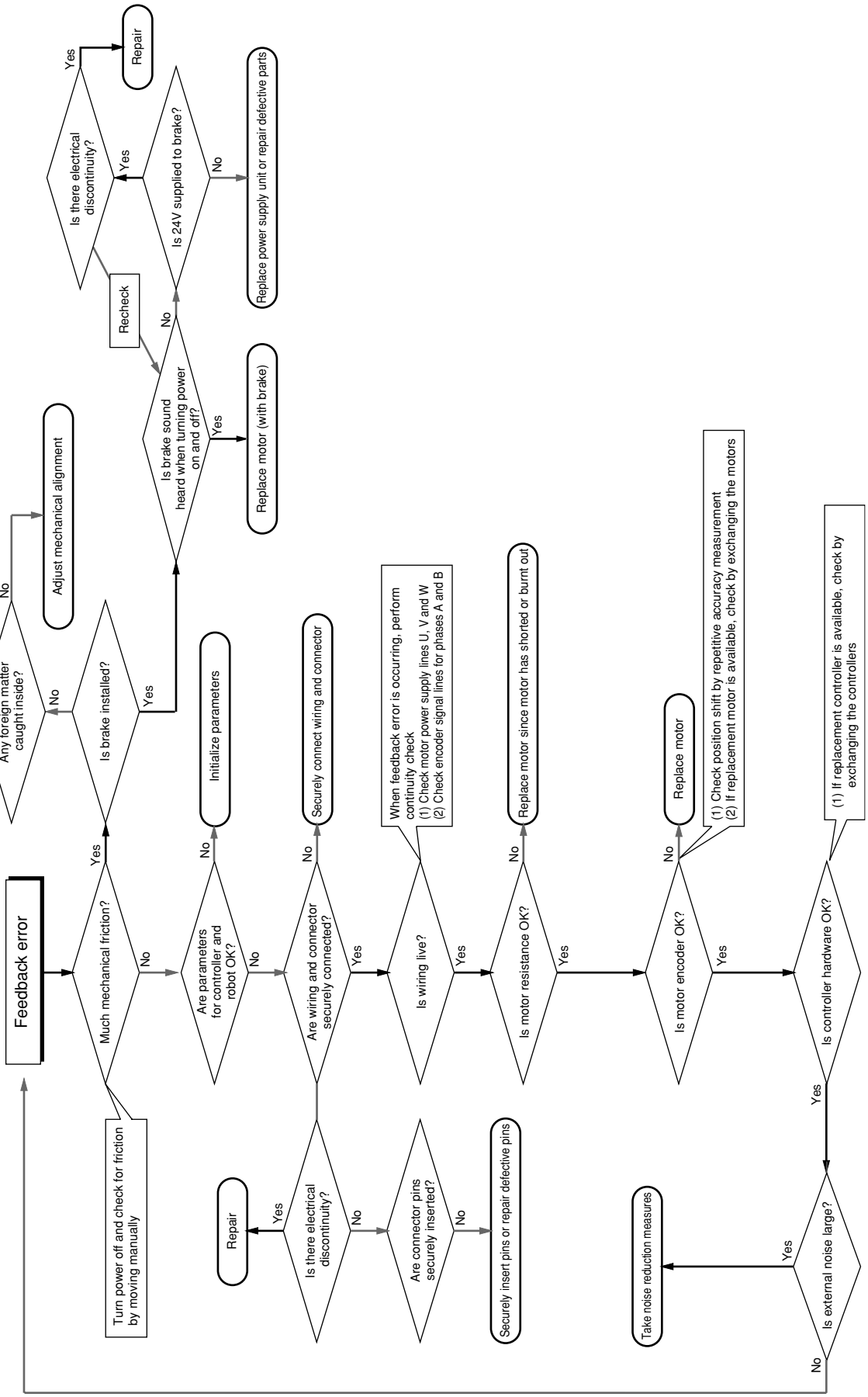


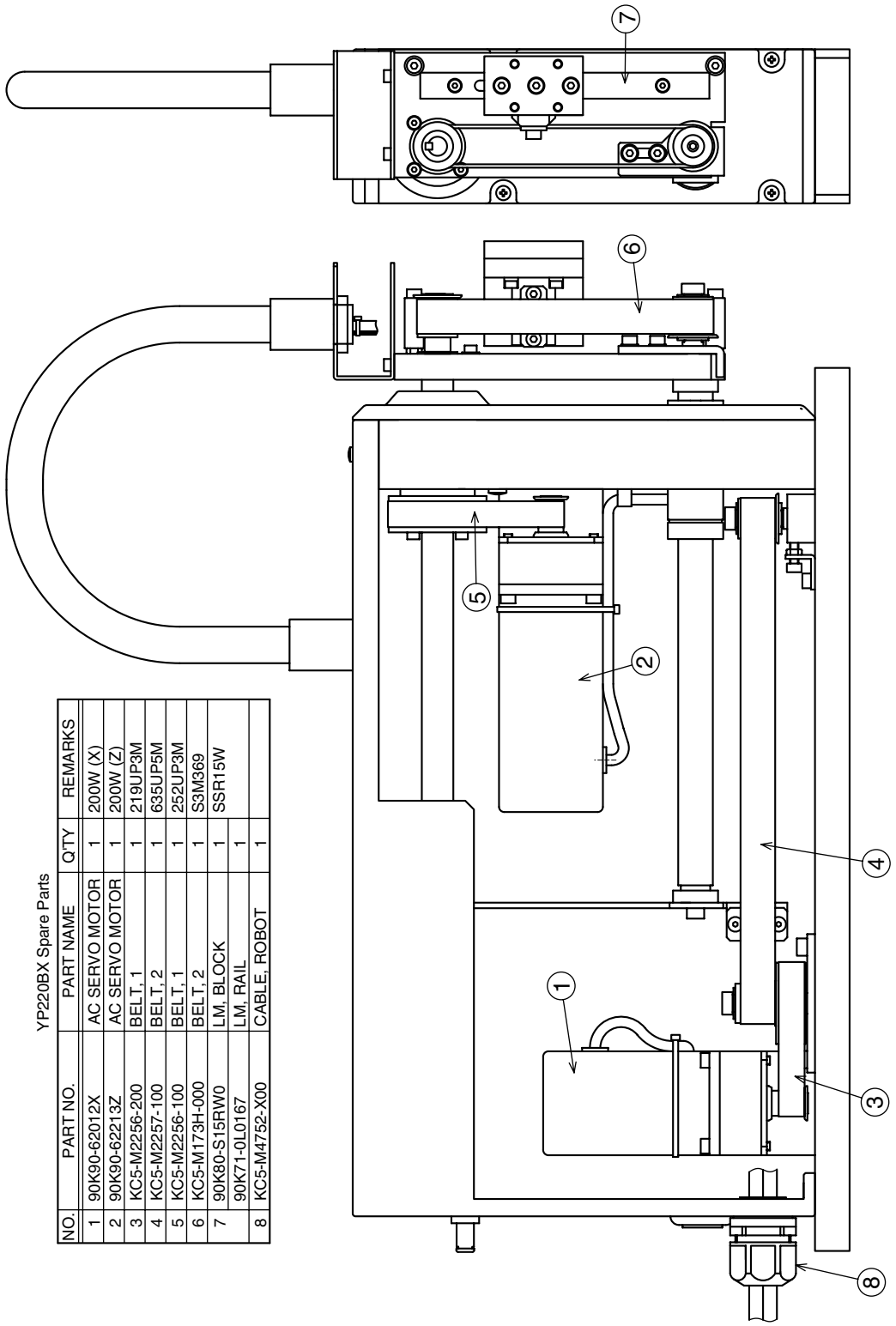
Fig. 5-10 Belt replacement

5 Sample troubleshooting


Position deviates.
Operation was correct, but position deviates.
Does the position return after return to origin?
No
Mechanical cause
(1) Check for looseness of mechanical parts. Retighten if necessary.
(2) Replace mechanical parts.
Yes
Electrical cause
Is there a large source of noise nearby?
No
Check or replace the motor, cable and controller.
Yes
Take measures against noise.
Robot bumped into something, or there are traces of bumping into (rubbing against) something.
Is cable broken?
Yes
Replace the cable
No
(1) Check tool and workpiece for warping.
(2) Check robot coupling for slipping and belt for teeth skipping.
The position deviates after moving the robot or set up of workpiece tool.
Are cables correctly wired?
Are connectors correctly fitted?
No
Check wiring and connectors.
Yes
Are the robot, tools and workpiece correctly installed?
No
Check installation method.
Yes
Check for looseness of robot mechanical parts.


Feedback error
Much mechanical friction?
Yes
No
Turn power off and check for friction by moving manually
Are parameters for controller and robot OK?
No
Initialize parameters
Are wiring and connector securely connected?
No
Securely connect wiring and connector
When feedback error is occurring, perform continuity check
(1) Check motor power supply lines U, V and W
(2) Check encoder signal lines for phases A and B
Is wiring live?
Yes
Replace motor since motor has shorted or burnt out
Is motor resistance OK?
Yes
No
Replace motor
(1) Check position shift by repetitive accuracy measurement
(2) If replacement motor is available, check by exchanging the motors
Is motor encoder OK?
Yes
No
(1) If replacement controller is available, check by exchanging the controllers
Is controller hardware OK?
Yes
No
Is external noise large?
Yes
No
Take noise reduction measures
Are connector pins securely inserted?
No
Securely insert pins or repair defective pins
Is there electrical discontinuity?
Yes
No
Repair
Is brake installed?
Yes
No
Adjust mechanical alignment
Any foreign matter caught inside?
No
Is brake sound heard when turning power on and off?
Yes
No
Replace motor (with brake)
Recheck
Is 24V supplied to brake?
Yes
No
Replace power supply unit or repair defective parts
Is there electrical discontinuity?
Yes
Repair

6 Spare parts list

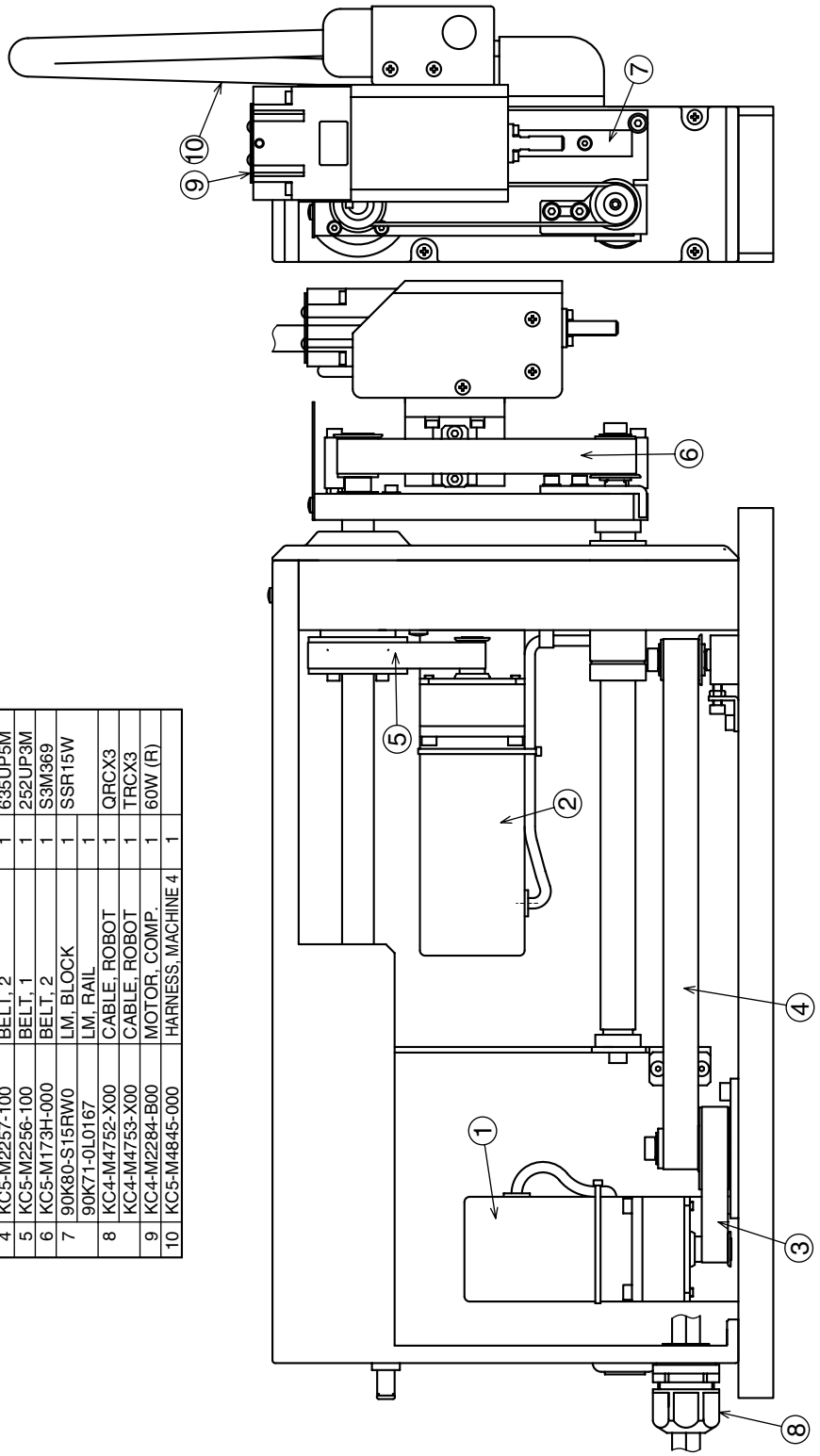


YP220BX Spare Parts

NO.	PART NO.	PART NAME	Q'TY	REMARKS
1	90K90-62012X	AC SERVO MOTOR	1	200W (X)
2	90K90-62213Z	AC SERVO MOTOR	1	200W (Z)
3	KC5-M2256-200	BELT, 1	1	219UP3M
4	KC5-M2257-100	BELT, 2	1	635UP5M
5	KC5-M2256-100	BELT, 1	1	252UP3M
6	KC5-M173H-000	BELT, 2	1	S3M369
7	90K80-S15RW0	LM, BLOCK	1	SSR15W
	90K71-0L0167	LM, RAIL	1	
8	KC5-M4752-X00	CABLE, ROBOT	1	

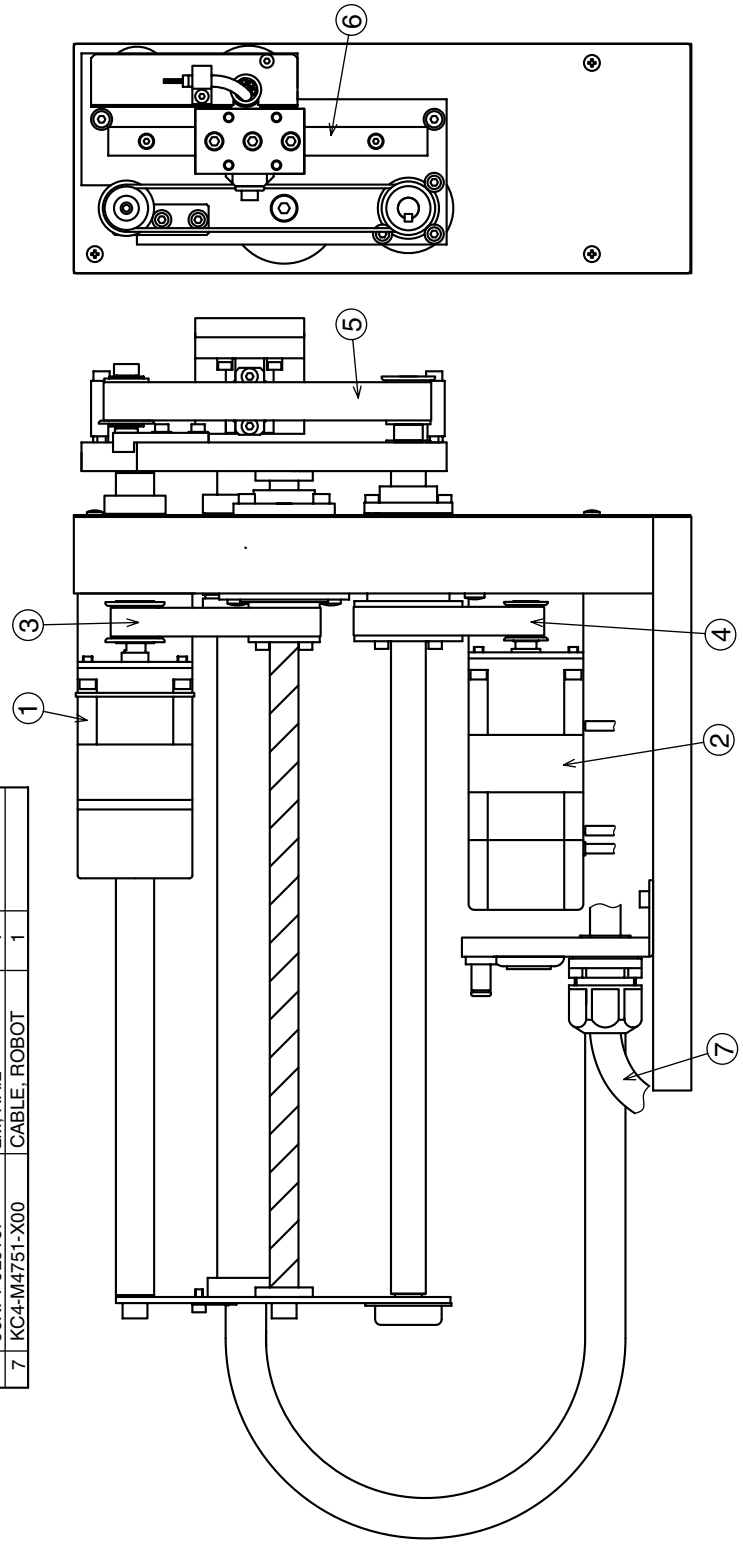
YP220BXR Spare Parts

NO.	PART NO.	PART NAME	Q'TY	REMARKS
1	90K90-62012X	AC SERVO MOTOR	1	200W (X)
2	90K90-62213Z	AC SERVO MOTOR	1	200W (Z)
3	KC5-M2256-200	BELT, 1	1	219UP3M
4	KC5-M2257-100	BELT, 2	1	635UP5M
5	KC5-M2256-100	BELT, 1	1	252UP3M
6	KC5-M173H-000	BELT, 2	1	S3M369
7	90K80-S15RW0	LM, BLOCK	1	SSR15W
	90K71-0L0167	LM, RAIL	1	
8	KC4-M4752-X00	CABLE, ROBOT	1	QRCX3
	KC4-M4753-X00	CABLE, ROBOT	1	TRCX3
9	KC4-M2284-B00	MOTOR, COMP.	1	60W (R)
10	KC5-M4845-000	HARNESS, MACHINE 4	1	



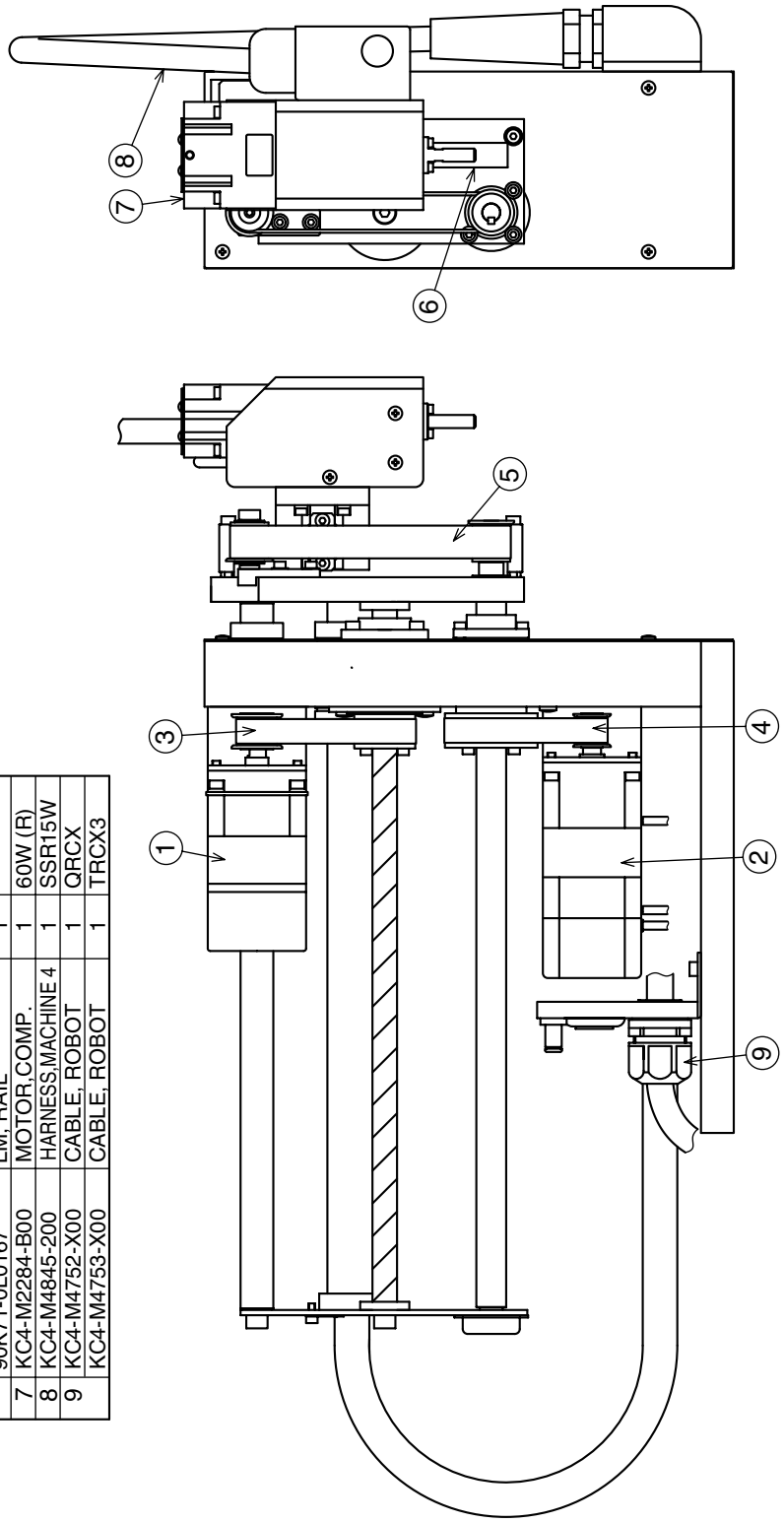
YP320X Spare Parts

NO.	PART NO.	PART NAME	Q'TY	REMARKS
1	KC4-M4881-000	AC SERVO MOTOR	1	200W (X)
2	90K90-62212Z	AC SERVO MOTOR	1	200W (Z)
3	KC0-M2256-100	BELT, 1	1	S5M255
4	KC0-M2256-000	BELT, 1	1	S3M252
5	KC5-M173H-000	BELT, 2	1	S3M369
6	90K80-S15RW0	LM, BLOCK	1	SSR15W
	90K71-0L0167	LM, RAIL	1	
7	KC4-M4751-X00	CABLE, ROBOT	1	



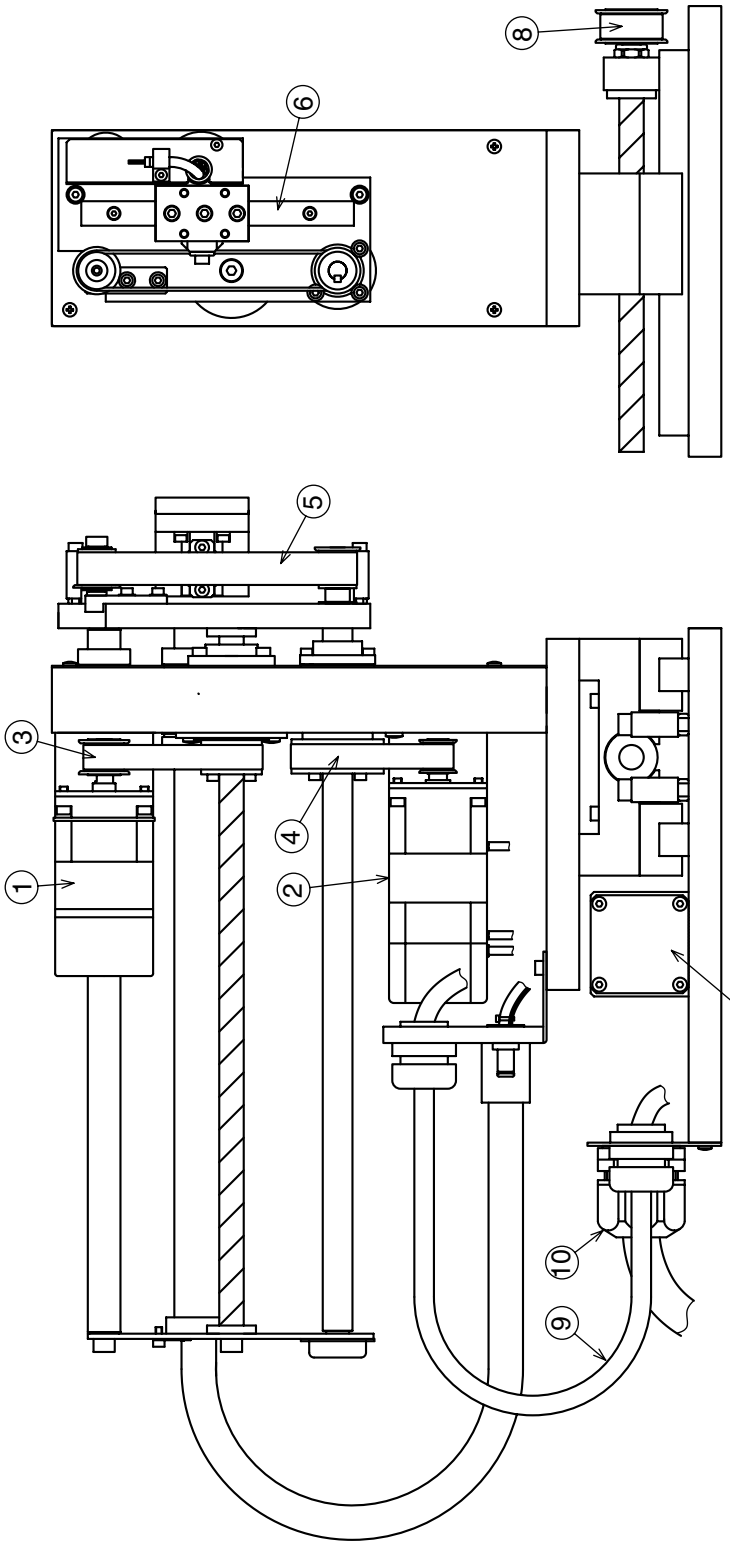
YP320XR Spare Parts

NO.	PART NO.	PART NAME	Q'TY	REMARKS
1	KC4-M4881-000	AC SERVO MOTOR	1	200W (X)
2	90K90-62212Z	AC SERVO MOTOR	1	200W (Z)
3	KC0-M2256-100	BELT, 1	1	S5M255
4	KC0-M2256-000	BELT, 1	1	S3M252
5	KC5-M173H-000	BELT, 2	1	S3M369
6	90K80-S15RW0	LM, BLOCK	1	SSR15W
	90K71-0L0167	LM, RAIL	1	
7	KC4-M2284-B00	MOTOR,COMP.	1	60W (R)
8	KC4-M4845-200	HARNESS,MACHINE 4	1	SSR15W
9	KC4-M4752-X00	CABLE, ROBOT	1	QRCX
	KC4-M4753-X00	CABLE, ROBOT	1	TRCX3



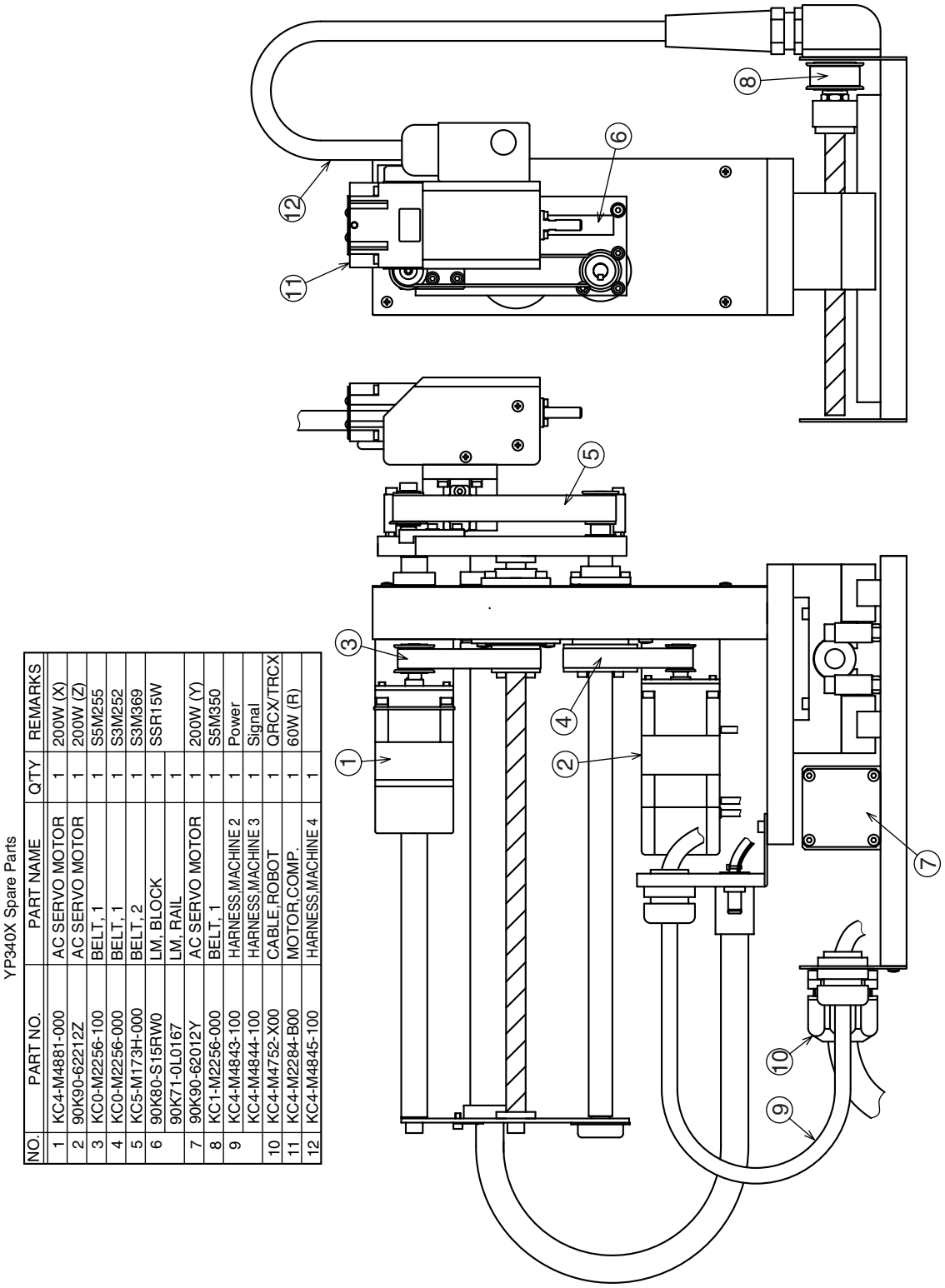
YP330X Spare Parts

NO.	PART NO.	PART NAME	QTY	REMARKS
1	KC4-M4881-000	AC SERVO MOTOR	1	200W (X)
2	90K90-62212Z	AC SERVO MOTOR	1	200W (Z)
3	KC0-M2256-100	BELT, 1	1	S5M255
4	KC0-M2256-000	BELT, 1	1	S3M252
5	KC5-M173H-000	BELT, 2	1	S3M369
6	90K80-S15RW0	LM, BLOCK	1	SSR15W
	90K71-OL0167	LM, RAIL	1	
7	90K90-62012Y	AC SERVO MOTOR	1	200W (Y)
8	KC1-M2256-000	BELT,1	1	S5M350
9	KC4-M4843-100	HARNESS,MACHINE 2	1	Power
	KC4-M4844-100	HARNESS,MACHINE 3	1	Signal
10	KC4-M4752-X00	CABLE,ROBOT	1	QRCX
	KC4-M4753-X00	CABLE,ROBOT	1	TRCX



YP340X Spare Parts

NO.	PART NO.	PART NAME	QTY	REMARKS
1	KC4-M4881-000	AC SERVO MOTOR	1	200W (X)
2	90K90-62212Z	AC SERVO MOTOR	1	200W (Z)
3	KC0-M2256-100	BELT, 1	1	S5M255
4	KC0-M2256-000	BELT, 1	1	S3M252
5	KC5-M173H-000	BELT, 2	1	S3M369
6	90K80-S15RW0	LM, BLOCK	1	SSR15W
	90K71-0L0167	LM, RAIL	1	
7	90K90-62012Y	AC SERVO MOTOR	1	200W (Y)
8	KC1-M2256-000	BELT, 1	1	S5M350
9	KC4-M4843-100	HARNESS,MACHINE 2	1	Power
	KC4-M4844-100	HARNESS,MACHINE 3	1	Signal
10	KC4-M4752-X00	CABLE,ROBOT	1	QRCX/TRCX
11	KC4-M2284-B00	MOTOR,COMP.	1	60W (R)
12	KC4-M4845-100	HARNESS,MACHINE 4	1	



CHAPTER 6

Specifications

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2-1 R axis allowable moment/inertia moment 6-18

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MEMO

1 P & P robot unit

1-1 Basic specifications

		YP220BX	YP220BXR	YP320X	YP320XR	YP330X	YP340X
No. of axes		2	3	2	3	3	4
Motor output	X-axis (fwd/rev)	200W	200W	200W	200W	200W	200W
	Y-axis (rt/lt.)	–	–	–	–	200W	200W
	Z -axis (up/down)	200W	200W	200W	200W	200W	200W
	R-axis (rotation)	–	60W	–	60W	–	60W
Drive method (Note 1)	X-axis	belt (lead 24 or equiv)	belt (lead 24 or equiv)	ball screw (lead 20 or equiv)	ball screw (lead 20 or equiv)	ball screw (lead 20 or equiv)	ball screw (lead 20 or equiv)
	Y-axis	–	–	–	–	ball screw (lead 20 or equiv)	ball screw (lead 20 or equiv)
	Z-axis	belt (lead 20 or equiv)	belt (lead 20 or equiv)	belt (lead 25 or equiv)	belt (lead 25 or equiv)	belt (lead 25 or equiv)	belt (lead 25 or equiv)
	R-axis	–	transmission (1/18)	–	transmission (1/18)	–	transmission (1/18)
Maximum transportable weight		3kg	1kg	3kg	1kg	3kg	1kg
Repeatable precision (Note 2)	X-axis	±0.05mm	±0.05mm	±0.02mm	±0.02mm	±0.02mm	±0.02mm
	Y-axis	–	–	–	–	±0.02mm	±0.02mm
	Z-axis	±0.05mm	±0.05mm	±0.05mm	±0.05mm	±0.05mm	±0.05mm
	R-axis	–	±0.1°	–	±0.1°	–	±0.1°
Working range	X-axis	200mm	200mm	330mm	330mm	330mm	330mm
	Y-axis	–	–	–	–	150mm	150mm
	Z-axis	100mm	100mm	100mm	100mm	100mm	100mm
	R-axis	–	±180°	–	±180°	–	±180°
Weight		17kg	19kg	21kg	23kg	32kg	34kg
Controller		DRCX QRCX2	TRCX3 QRCX3	DRCX QRCX2	TRCX3 QRCX3	TRCX3 QRCX3	TRCX4 QRCX4

Note 1:
Ball screw precision class is C7

Note 2:
- Value during one-sided vibration (moving in 1 direction)
- Value while controlling residual vibration (changes with load and stroke)

Maximum sound pressure level of robot (at 10dB or more difference from background sound pressure)	75dB
Robot Model	YP220BX
Position of maximum sound pressure level	1.0m away from the front of the robot, at 1.6m height

1-2 Robot External Views

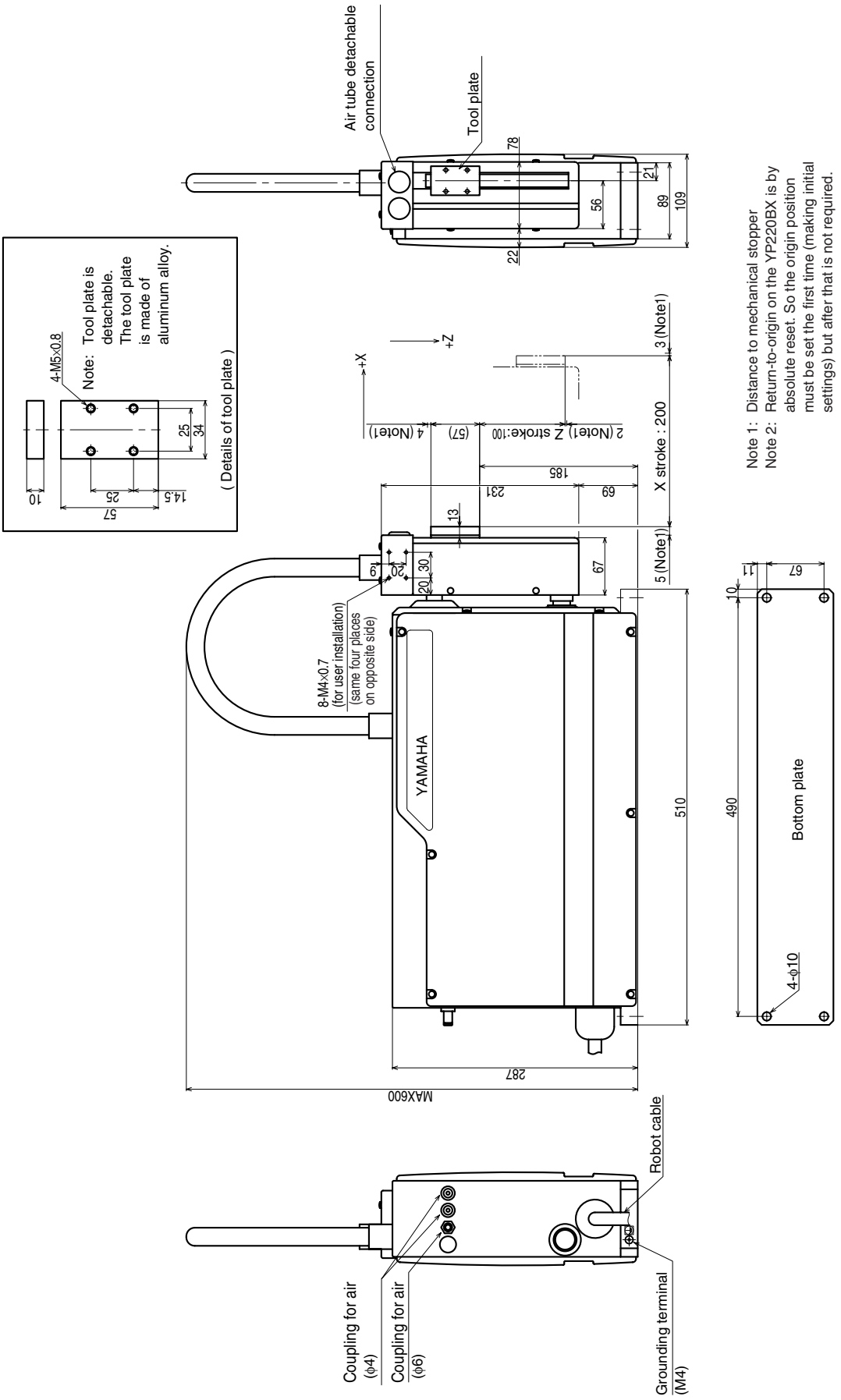


Fig. 6-1 YP220BX robot external view

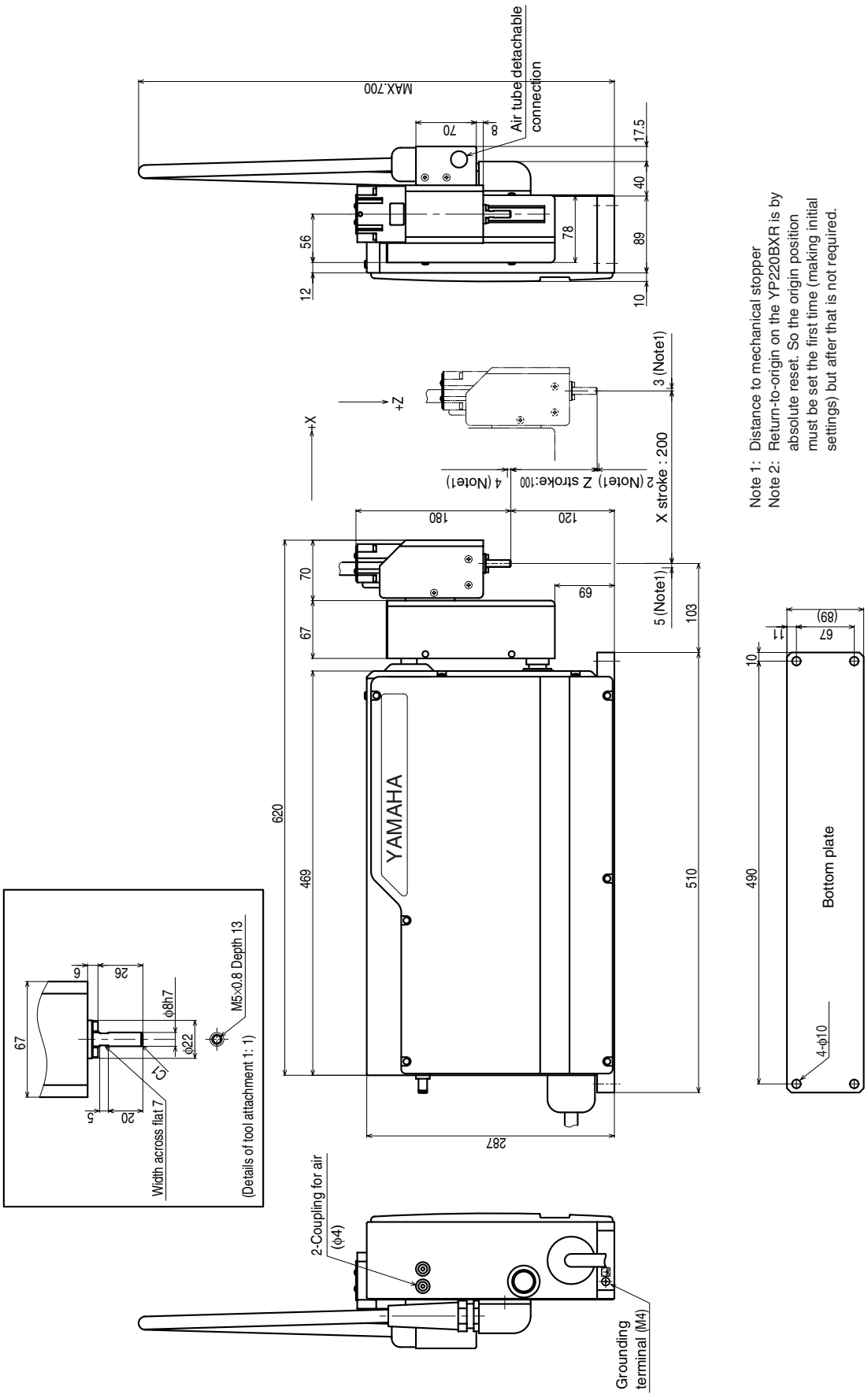


Fig. 6-2 YP220BXR robot external view

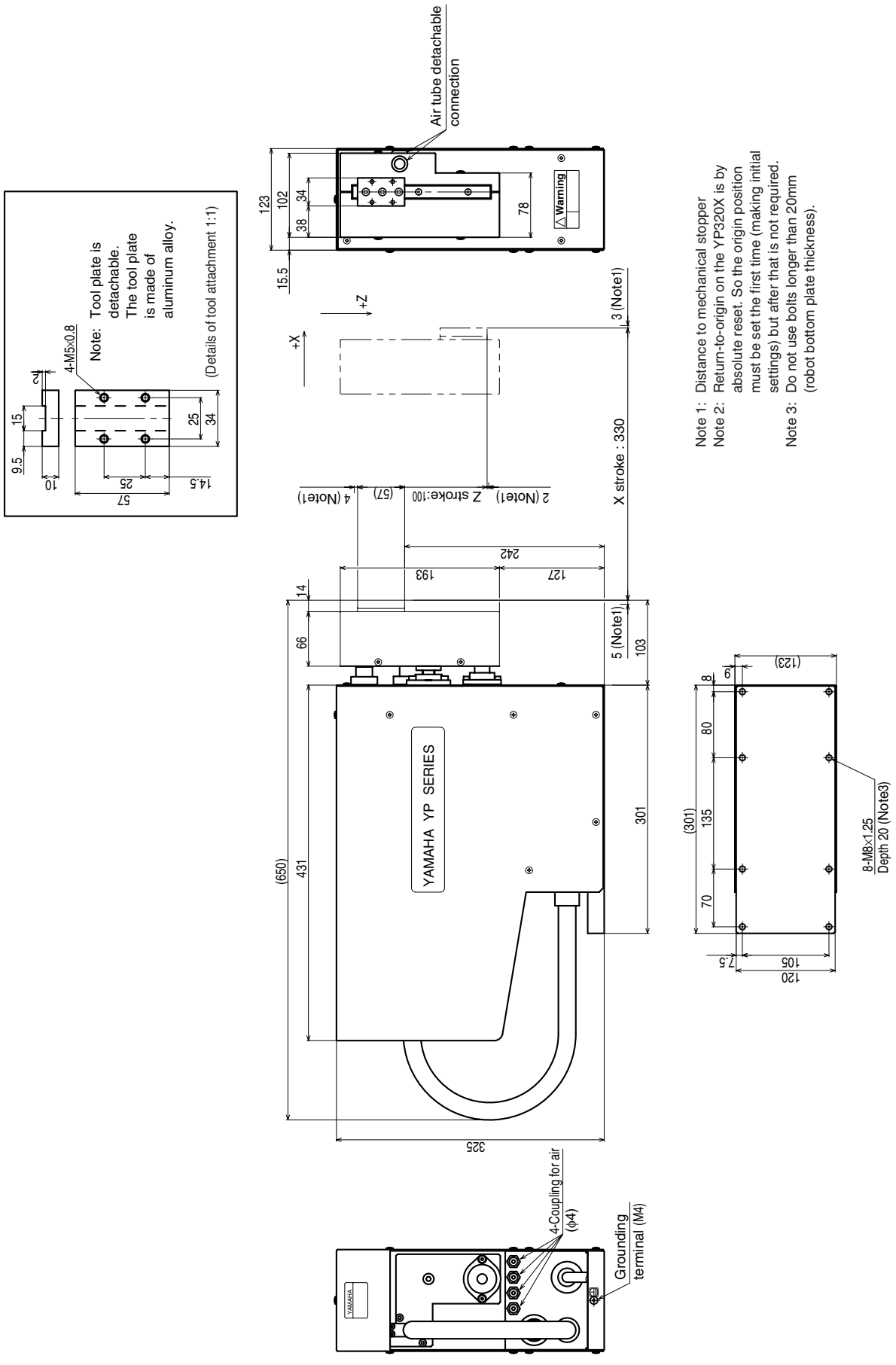


Fig. 6-3 YP320X robot external view

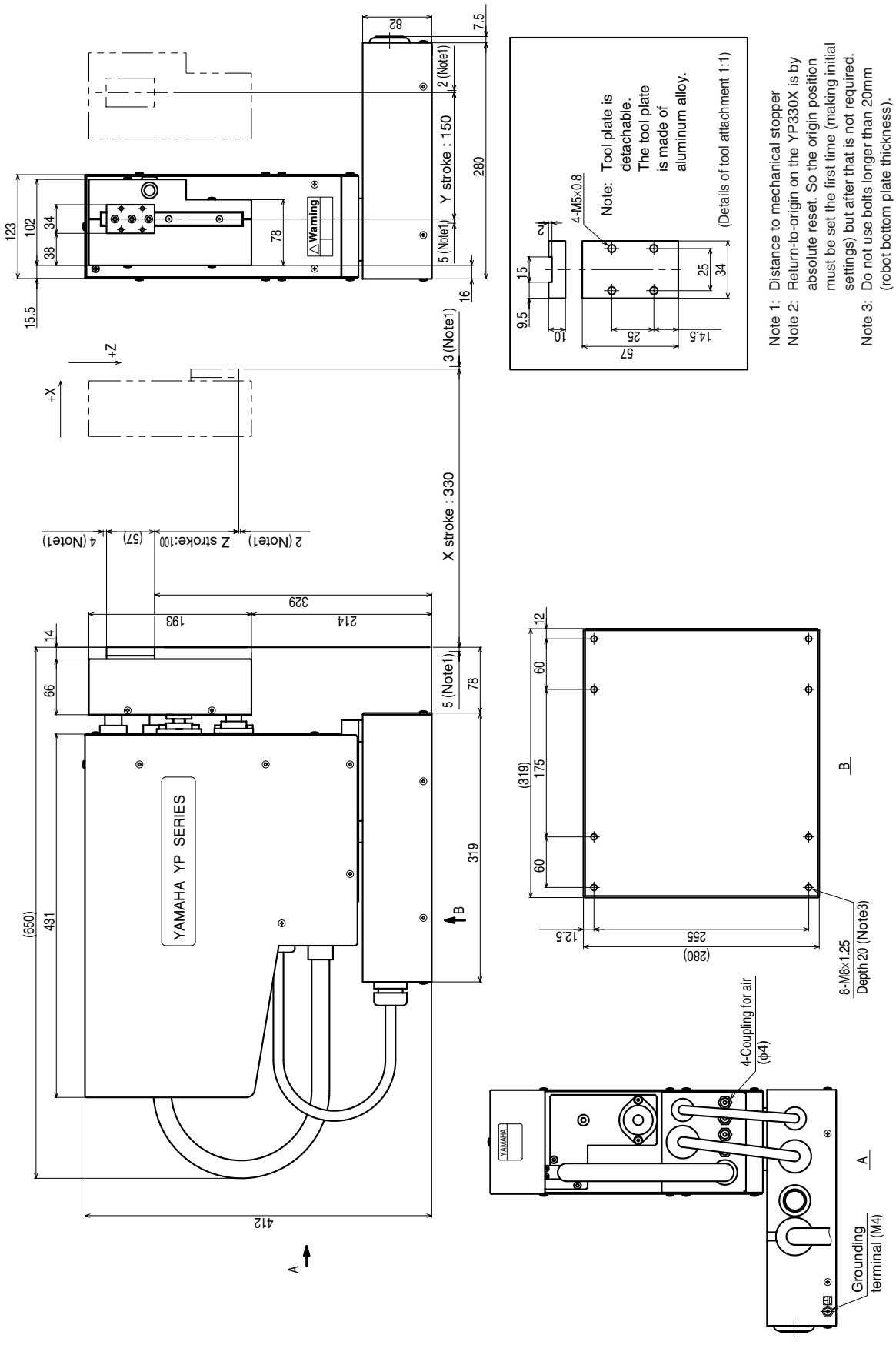

Note 1: Distance to mechanical stopper
Note 2: Return-to-origin on the YP330X is by absolute reset. So the origin position must be set the first time (making initial settings) but after that is not required.
Note 3: Do not use bolts longer than 20mm (robot bottom plate thickness).
Note: Tool plate is detachable. The tool plate is made of aluminum alloy.
(Details of tool attachment 1:1)
4-M5×0.8
Y stroke : 150
X stroke : 330
Z stroke:100
Warning
YAMAHA YP SERIES
4-Coupling for air (ϕ4)
8-M8×1.25 Depth 20 (Note3)
Grounding terminal (M4)

Fig. 6-4 YP330X robot external view

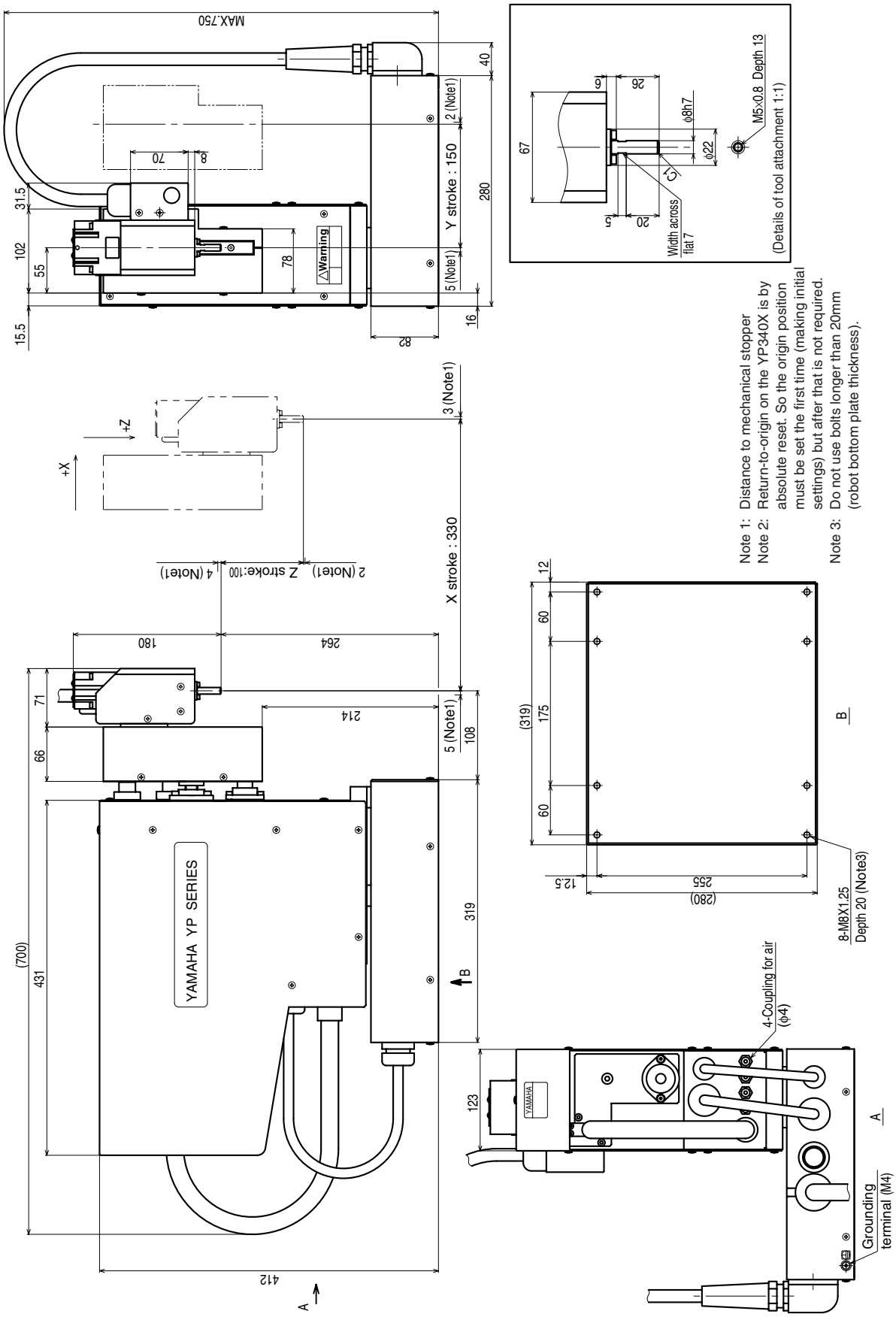


Fig. 6-5 YP340X robot external view

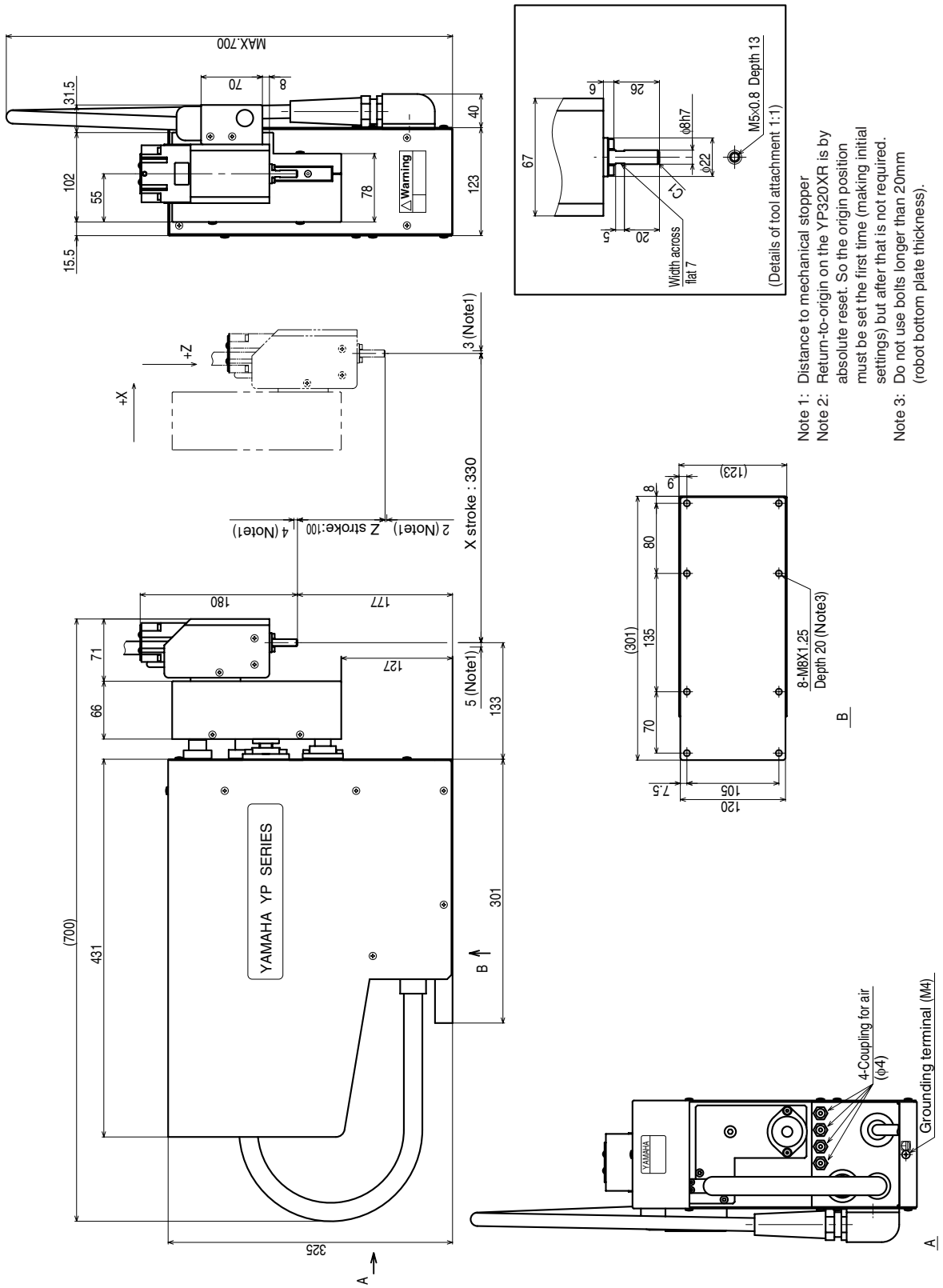


Fig. 6-6 YP320XR robot external view

1-3 Table of robot control signals

1) YP340X, TRCX4, QRCX4
YP330X, YP320XR, YP220BXR and QRCX3

Robot side				Controller side		
Signal	Connector	No	Connection	No	Connector	Color/No.
Resolver S2	ZP	1		1	ZR	Blue
S4		2		2		Orange
S1		3		3		Green
S3		4		4		Brown
R1		5		5		Gray
R2		6		6		Red
DG		7		7		Green
Brake MB+	ZBK	1		14		Black
MB-		2		16		Yellow
Resolver S2	RP	1		19		Pink
S4		2		20		Purple
S1		3		21		White
S3		4		22		Blue/Red
R1		5		23		Orange/White
R2		6		24		Green/White
DG		7		25		Green
Brake MB+	RBK	1		32		Brown/White
MB-		2		34		Gray/White
HLIM				10		Green
GND24				11		
HLIM				28		Green
GND24				29		
U	ZM	1		2	ZM	1
V		2		3		2
W		3		4		3
U	RM	1		2	RM	4
V		2		3		5
W		3		4		6
FG	Round terminal			1		Yellow/Green

Robot side				Controller side		
Signal	Connector	No	Connection	No	Connector	Color/No.
Resolver S2	XP	1		1	XY	Blue
S4		2		2		Orange
S1		3		3		Green
S3		4		4		Brown
R1		5		5		Gray
R2		6		6		Red
DG		7		7		Green
Brake MB+	XBK	1		14		Black
MB-		2		16		Yellow
Resolver S2	YP	1		19		Pink
S4		2		20		Purple
S1		3		21		White
S3		4		22		Blue/Red
R1		5		23		Orange/White
R2		6		24		Green/White
DG		7		25		Green
Brake MB+	YBK	1		32		Brown/White
MB-		2		34		Gray/White
HLIM				10		Green
GND24				11		
HLIM				28		Green
GND24				29		
U	XM	1		2	XM	1
V		2		3		2
W		3		4		3
U	YM	1		2	YM	4
V		2		3		5
W		3		4		6
FG	Round terminal			1		Yellow/Green

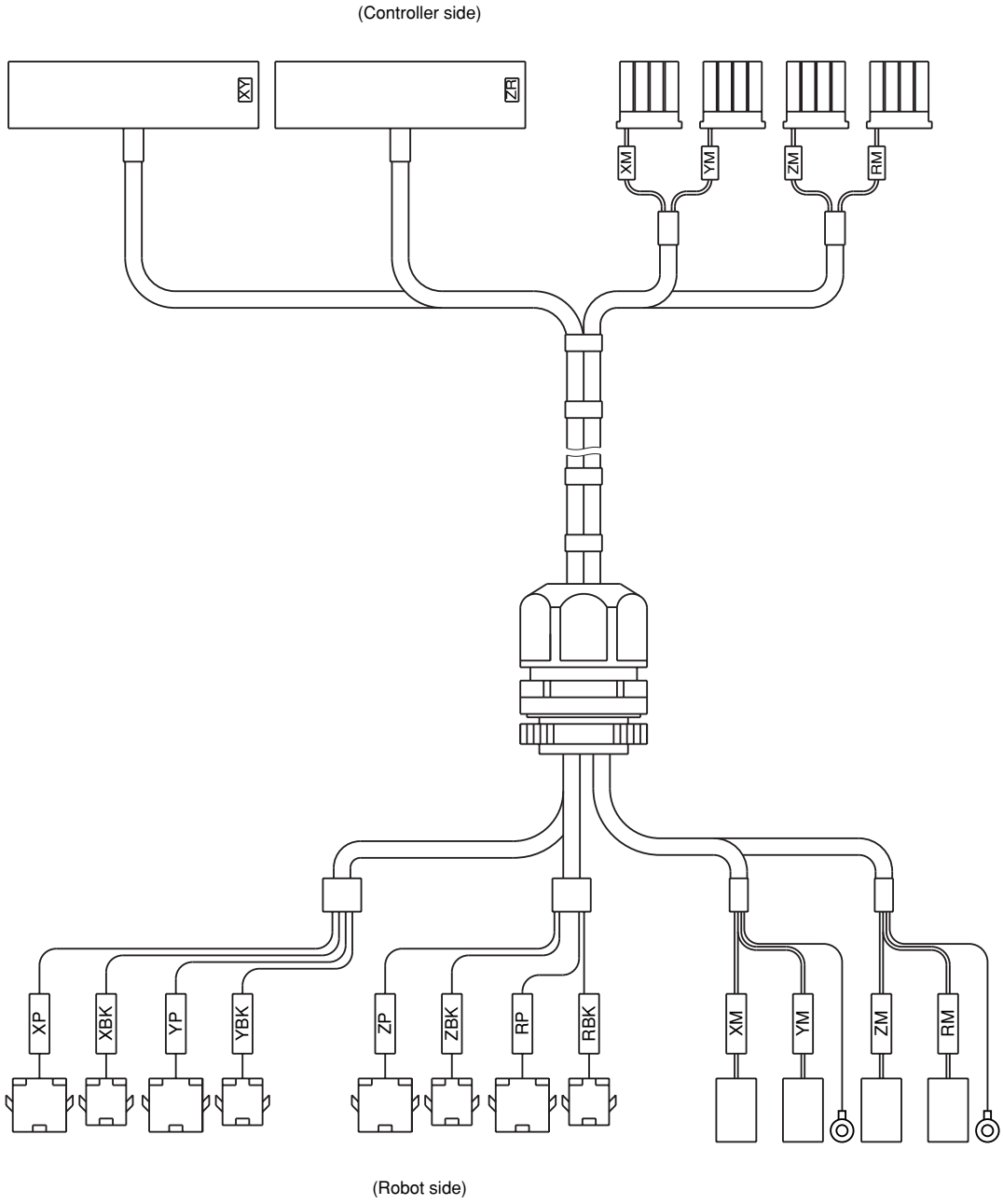


Fig. 6-7 Wiring between robot and controller

2) YP330X, YP320XR, YP220BXR and TRCX3

Robot side					Controller side		
Signal		Connector	No	Connection	No	Connector	Color/No.
Resolver	S2	ZP	1		1	Z	Blue
	S4		2		2		Orange
	S1		3		3		Green
	S3		4		4		Brown
	R1		5		5		Grey
	R2		6		6		Red
	DG		7		9		Green
Brake	MB+	ZBK	1		17		Black
	MB-		2		18		Yellow
	U	ZM	1		2	ZM	Red
	V		2		3		White
	W		3		4		Black
	FG	Round terminal			1		Yellow/green

Robot side					Controller side		
Signal		Connector	No	Connection	No	Connector	Color/No.
Resolver	S2	XP	1		1	XY	Blue
	S4		2		2		Orange
	S1		3		3		Green
	S3		4		4		Brown
	R1		5		5		Grey
	R2		6		6		Red
	DG		7		7		Green
Brake	MB+	XBK	1		14		Black
	MB-		2		16		Yellow
Resolver	S2	YP	1		19		Pink
	S4		2		20		Purple
	S1		3		21		White
	S3		4		22		Blue/Red
	R1		5		23		Orange/White
	R2		6		24		Green/White
	DG		7		25		Green
Brake	MB+	YBK	1		32		Brown/White
	MB-		2		34		Grey/White
	HLIM				10		Green
	GND24				11		
	HLIM				28		Green
	GND24				29		
	U	XM	1		2	XM	1
	V		2		3		2
	W		3		4		3
	U	YM	1		2	YM	4
	V		2		3		5
	W		3		4		6
	FG	Round terminal			1		Yellow/Green

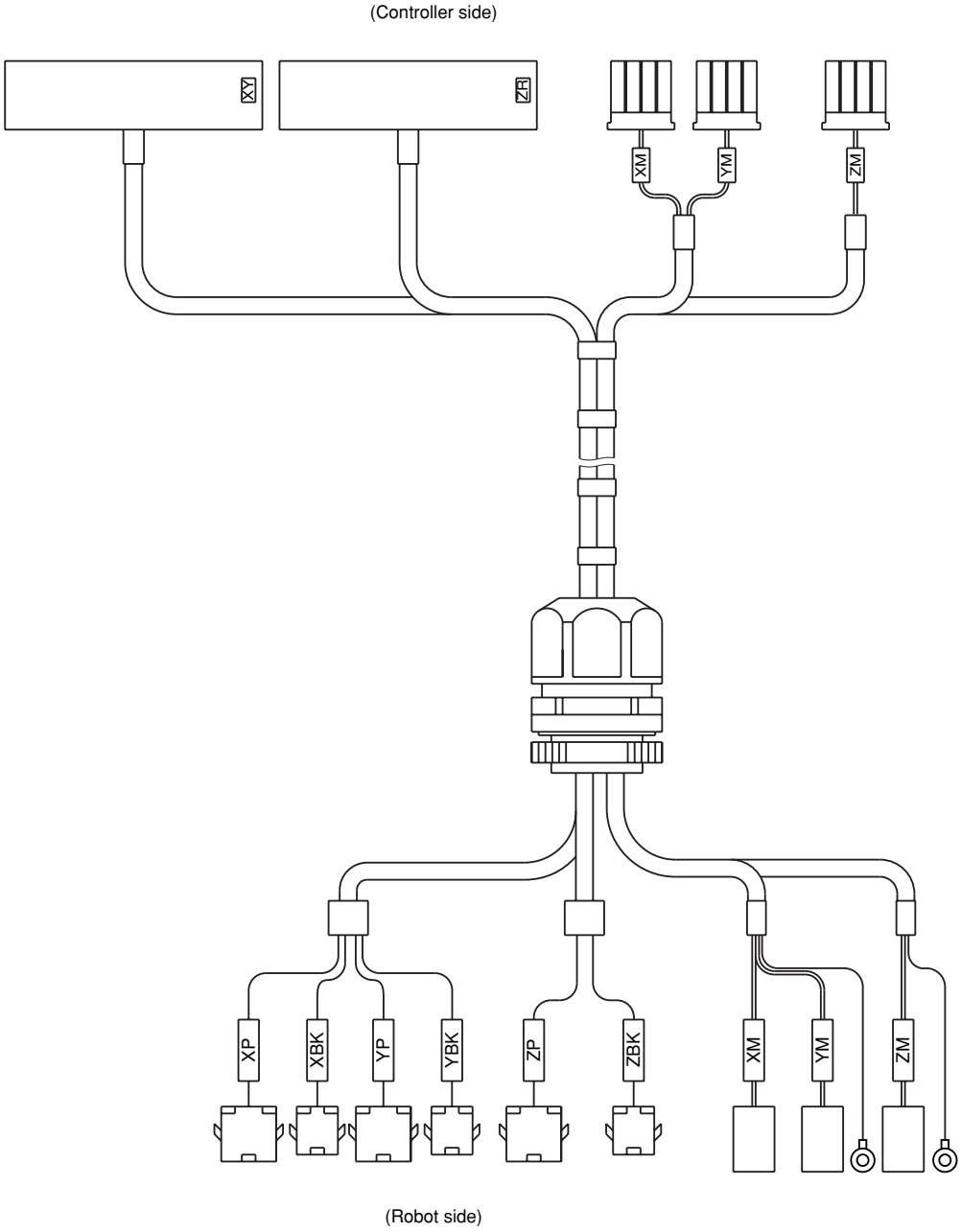


Fig. 6-8 Wiring between robot and controller

3) YP320X, YP220BX and DRCX, QRCX2

Robot side				Connection	Controller side		
Signal		Connector	No		No	Connector	Color/No.
Resolver	S2	P1	1		1		Blue
	S4		2		2		Orange
	S1		3		3		Green
	S3		4		4		Brown
	R1		5		5		Grey
	R2		6		6		Red
	DG		7		7		Green
Brake	MB+	BK1	1		14		Black
	MB-		2		16		Yellow
Resolver	S2	P2	1		19		Pink
	S4		2		20		Purple
	S1		3		21		White
	S3		4		22		Blue/Red
	R1		5		23		Orange/White
	R2		6		24		Green/White
	DG		7		25		Green
Brake	MB+	BK2	1		32		Brown/White
	MB-		2		34		Grey/White
	HLIM				10		Green
	GND24				11		
	HLIM				28		Green
	GND24				29		
	U	M1	1		2	M1	1
	V		2		3		2
	W		3		4		3
	U	M2	1		2	M2	4
	V		2		3		5
	W		3		4		6
	FG	Round terminal			1		Yellow/Green

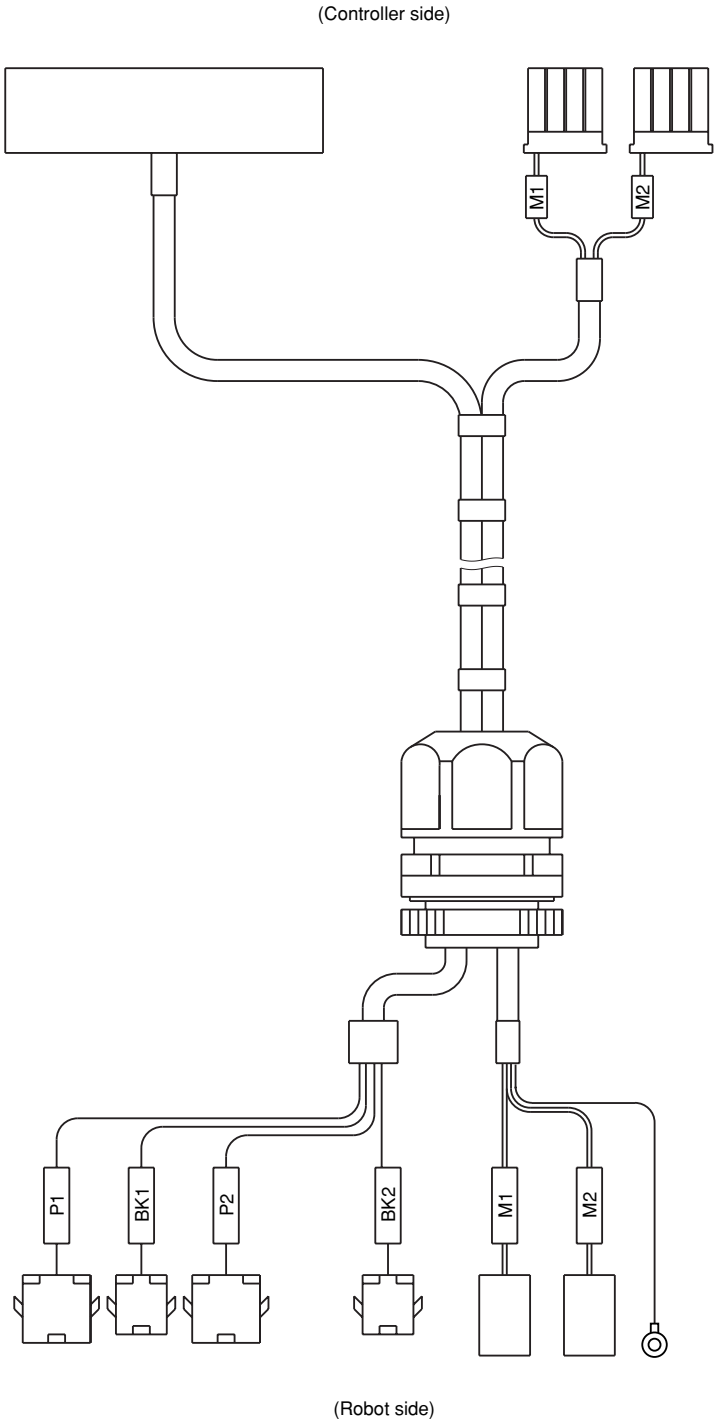


Fig. 6-9 Wiring between robot and controller

1-4 Piping and wiring of robot

User air tubing and wiring have been provided on the YP-X series robots.
Use these user air tubing and wiring when installing air chucks (gripper), vacuum pads and other tools.

1) YP320X, YP320XR

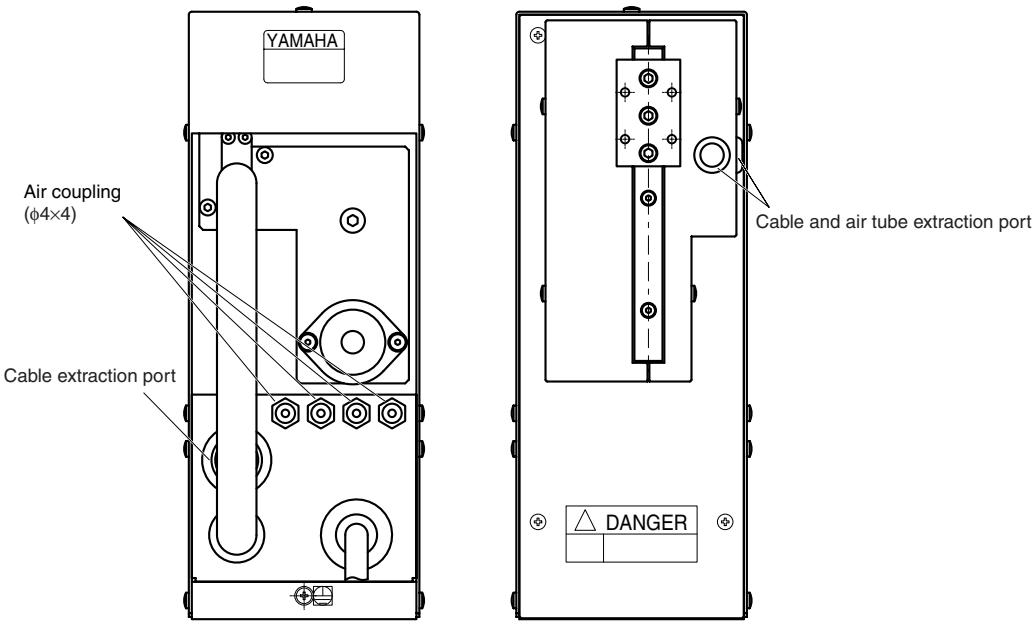


Fig. 6-10 User wiring and piping connections

As standard features, four air tubes (4mm dia.) and a cable (12 conductors, 0.2 sg.) are routed through the robot unit as shown below. These are provided for the user so utilize as needed.

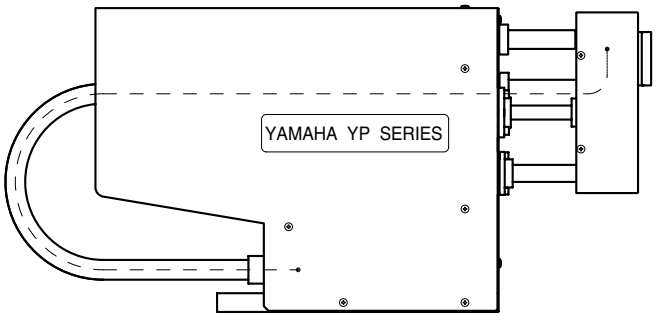


Fig. 6-11 User wiring and piping connections

2) YP330X, YP340X

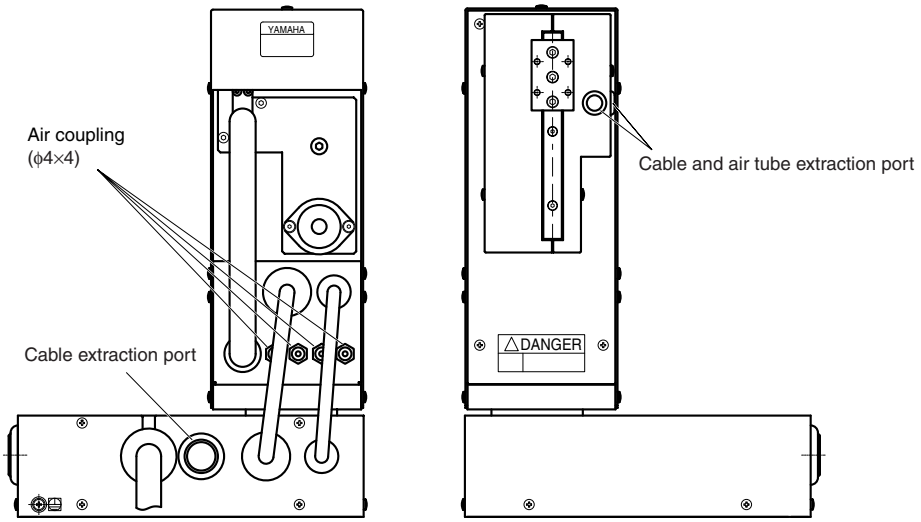


Fig. 6-12 User wiring and piping connections

As standard features, four air tubes (4mm dia.) and a cable (12 conductors, 0.2 sg.) are routed through the robot unit as shown below. These are provided for the user so utilize as needed.

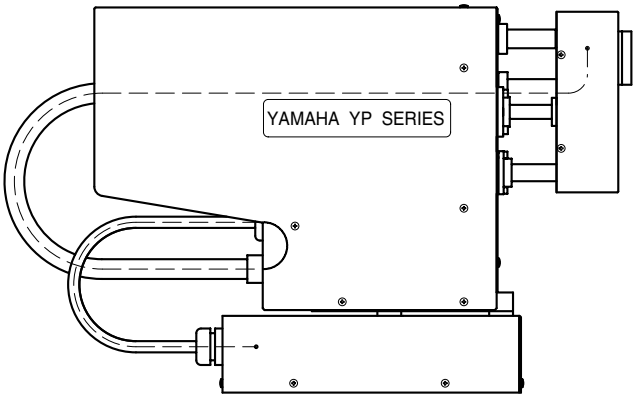


Fig. 6-13 User wiring and piping connections

3) YP220BX

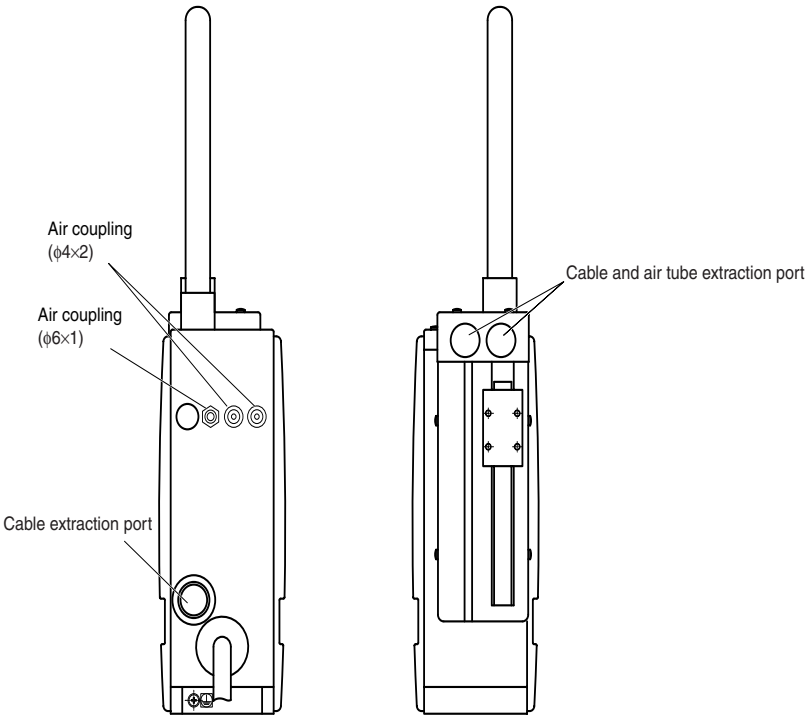


Fig. 6-14 User wiring and piping connections

In the standard configuration, one air tube (6mm diameter), two air tubes (4mm diameter) and one cable (12 conductor wires, 0.2sg.) run through the robot unit as shown below. These are provided for the user so feel free to use when needed.

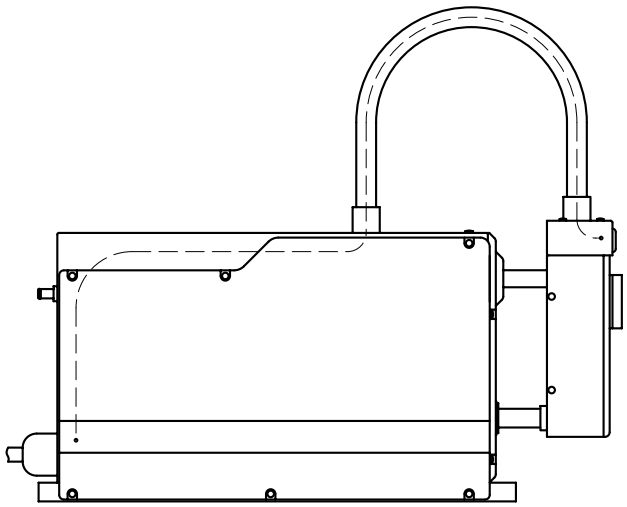


Fig. 6-15 User wiring and piping connections

4) YP220BXR

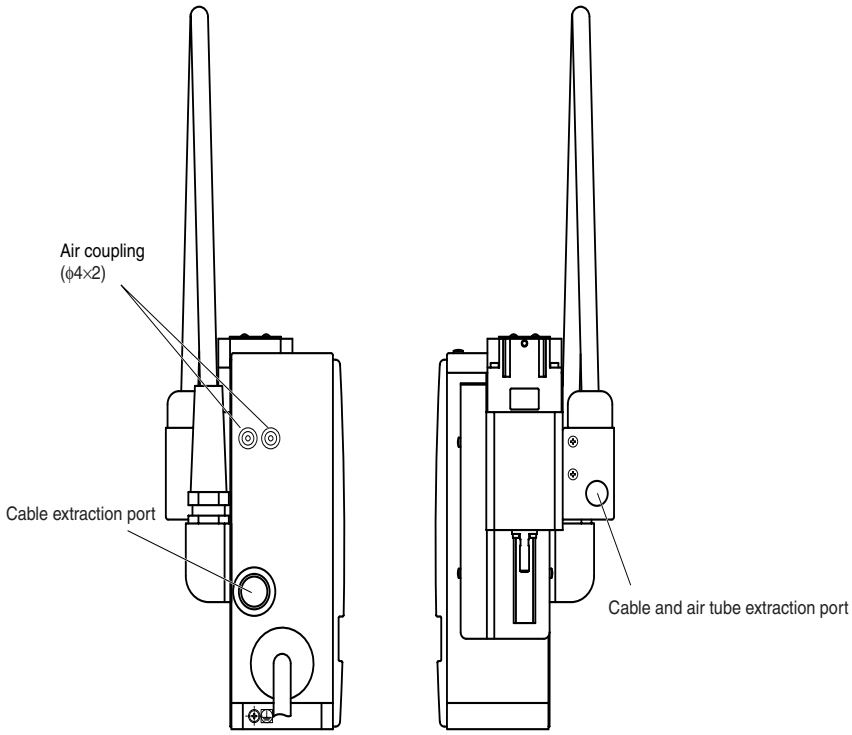


Fig. 6-16 User wiring and piping connections

As standard features, two air tubes (4mm dia.) and a cable (10 conductors, 0.2 sg.) are routed through the robot unit as shown below. These are provided for the user so utilize as needed.

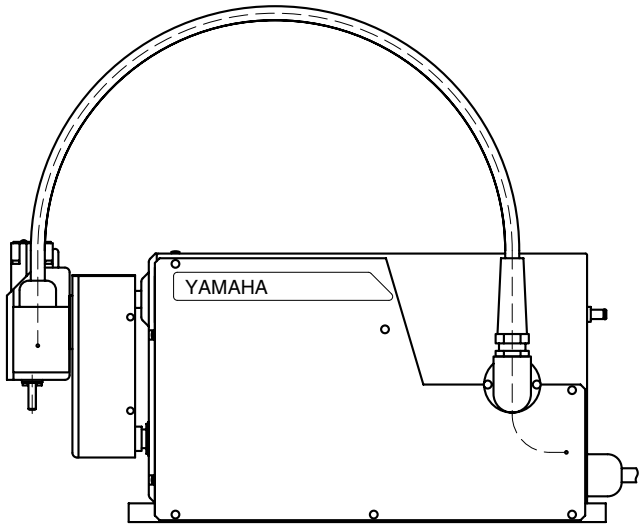


Fig. 6-17 User wiring and piping connections

2 R axis allowable moment/inertia moment

2-1 R axis allowable moment/inertia moment

Due to the robot R axis motor and speed reduction gear specifications, there is a limit to the load that can be applied to the R axis.
If the robot is operated with this limit exceeded, the above drive parts' lives will decrease and may cause breakage.
The limit of the R axis load is expressed with values called the tolerable moment and tolerable inertia moment.
For the YP340X, YP320XR, YP220BXR the maximum end weight is 1kg and the R axis tolerance inertia moment is 0.01 kg · cm · sec^2.

Refer to the examples for calculating the inertia moment on the following page and confirm that the inertia moment of the R axis load does not exceed the tolerance value.

⚠CAUTION

The robot must be operated with correct tolerable moment of inertia and acceleration coefficients according to the manipulator tip mass and moment of inertia. If this is not observed, premature end to the life of the drive units, damage to the robot parts or residual vibration during positioning may result.

2-2 Equation for moment of inertia calculation

Usually the R axis load is not a simple form, and the calculation of the moment of inertia is not easy.
As a method, the load is replaced with several factors that resemble a simple form for which the moment of inertia can be calculated. The total of the moment of inertia for these is obtained.

The objects and calculation methods often used for the calculation of the moment of inertia are shown below.

1. Moment of inertia for cylinder

   The equation for the moment of inertia for a cylinder that has a rotation center such as shown in Fig. 6-18 is given below.

$$J = \frac{\rho \pi D^4 h}{32g} = \frac{WD^2}{8g} \ (kg \cdot cm \cdot sec^2) \quad ...(6.1)$$

ρ : Density (kg/cm^3)
g : Gravitational acceration (cm/sec^2)
W : Weight of the cylinder (kg)

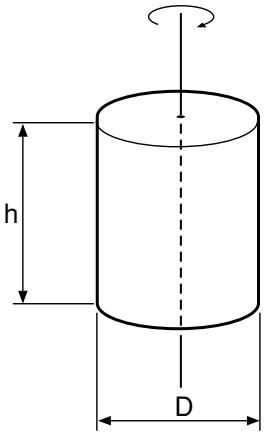


Fig. 6-18

2. Moment of inertia for rectangular parallelopiped

   The equation for the moment of inertia for a rectangular parallelopiped that has a rotation center as shown in Fig. 6-19 is given below.

$$J = \frac{\rho abc\,(a^2+b^2)}{12g} = \frac{W\,(a^2+b^2)}{12g} \quad ...(6.2)$$

ρ : Density (kg/cm^2)
g : Gravitational acceration (cm/sec^2)
W : Weight of the rectangular parallelepiped (kg)

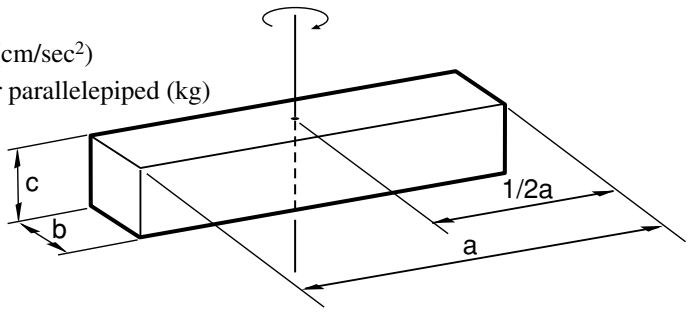


Fig. 6-19

3. When the object's center line is offset from the rotation center.

The equation for the moment of inertia, when the center of the cylinder is offset the amount of "x" from the rotation center as shown in Fig. 6-20, is given below.

$$J = \frac{\rho \pi D^4 h}{32g} + \frac{\rho \pi D^2 h x^2}{4g}$$

$$= \frac{WD^2}{8g} + \frac{Wx^2}{g} \quad (kg \cdot cm \cdot sec^2)$$

...(6.3)

W : Weight of the cylinder (kg)

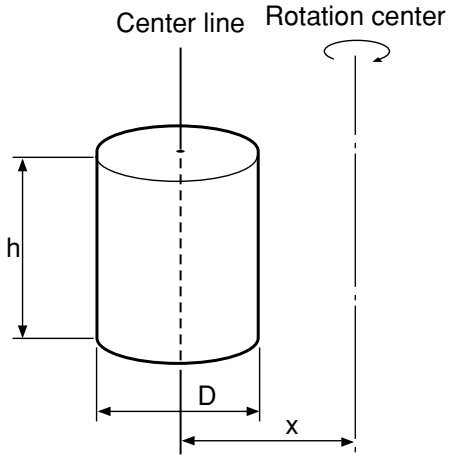


Fig. 6-20

In the same manner for the rectangular column in Fig. 6-21.

$$J = \frac{\rho abc (a^2+b^2)}{12g} + \frac{\rho abcx^2}{g}$$

$$= \frac{W (a^2+b^2)}{12g} + \frac{Wx^2}{g} \quad (kg \cdot cm \cdot sec^2)$$

...(6.4)

W : Weight of the rectangular column (kg)

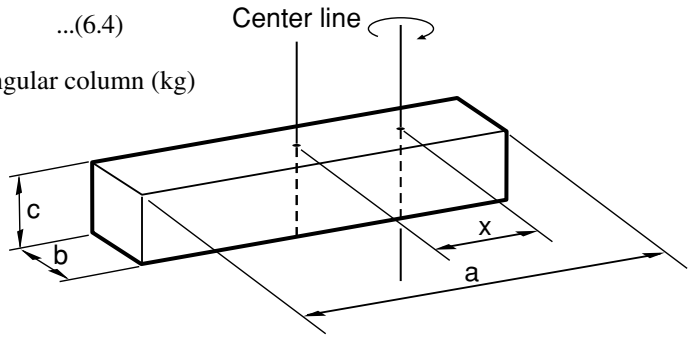


Fig. 6-21

2-3 Example of moment of inertia calculation

It will be assumed that the chuck and workpiece are at a position offset by 10cm from the R axis by the stay, as shown in Fig. 6-22.
The moment of inertia is calculated with the following three factors. However, the load material will be aluminum, and the density ρ=0.0026kg/cm^3.

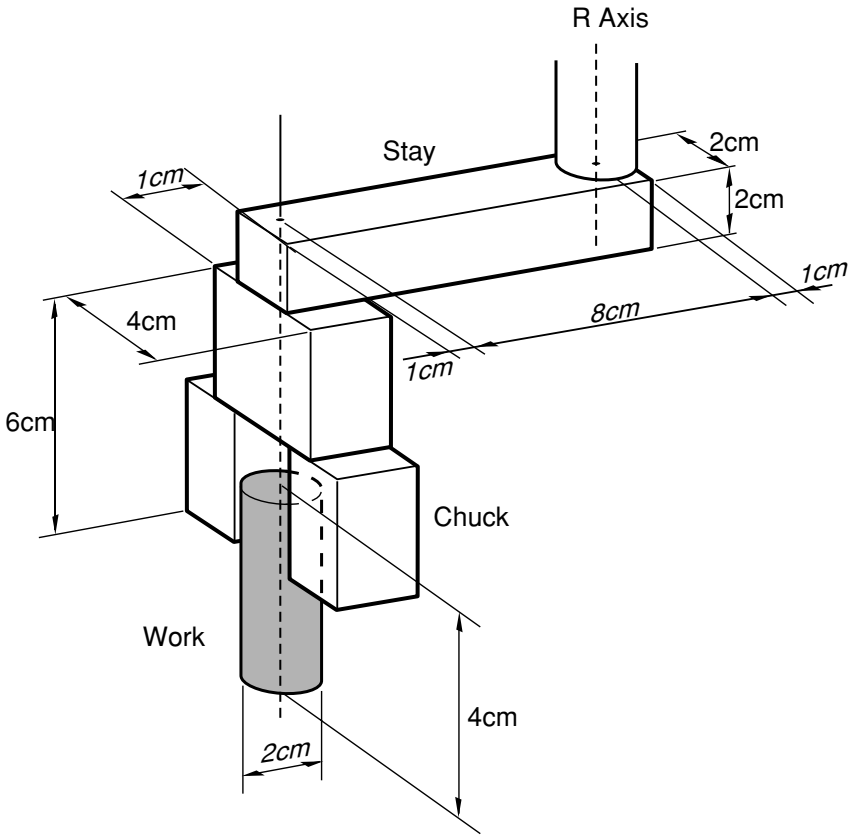
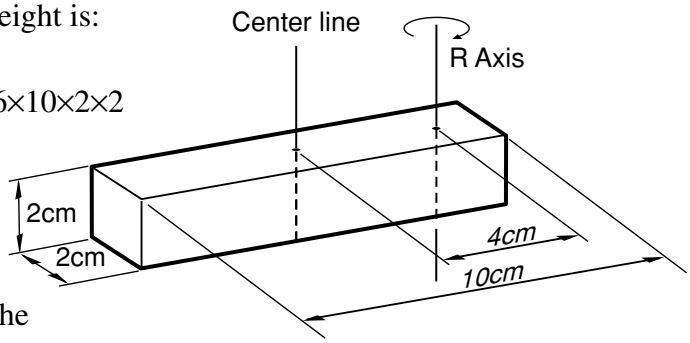


Fig. 6-22

1. Moment of inertia of the stay

   From Fig. 6-23, the weight is:

   $Ws = \rho abc = 0.0026 \times 10 \times 2 \times 2$
   $= 0.1$ (kg)



   From equation (6.4), the moment of inertia is:

$$Jc = \frac{0.1\times(10^2+2^2)}{12\times980} + \frac{0.1\times4^2}{980} = 0.0025\ (kg \cdot cm \cdot sec^2)$$

Fig. 6-23

2. Moment of inertia of the chuck

When the chuck form resembles that shown in Fig. 6-24:

$$Ws = 0.0026 \times 1 \times 4 \times 6$$
$$= 0.06 \text{ (kg)}$$

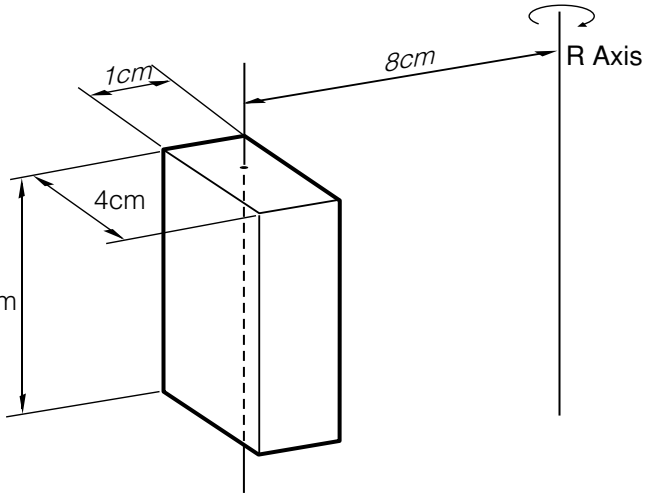


Fig. 6-24

From equation (6.4):

$$Jc = \frac{0.06 \times (1^2 + 4^2)}{12 \times 980} + \frac{0.06 \times 8^2}{980}$$
$$= 0.004 \text{ (kg} \cdot \text{cm} \cdot \text{sec}^2\text{)}$$

3. Moment of inertia of the workpiece

From Fig. 6-25:

$$Ww = \frac{\rho \pi D^2 h}{4} = \frac{0.0026\pi \times 2^2 \times 4}{4}$$
$$= 0.03 \text{ (kg)}$$

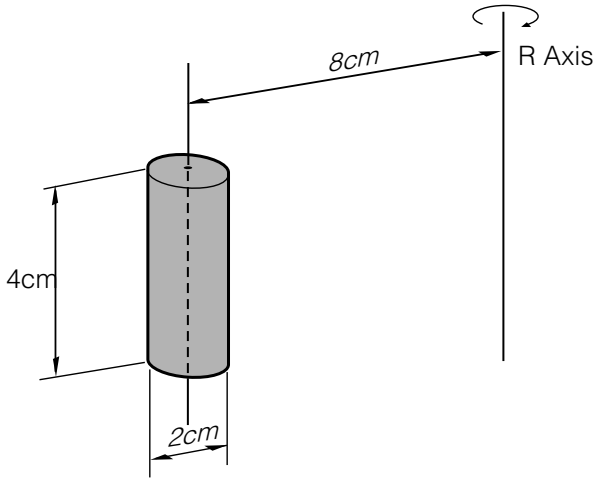


Fig. 6-25

From equation (6.3):

$$Jc = \frac{0.03 \times 2^2}{8 \times 980} + \frac{0.03 \times 8^2}{980}$$
$$= 0.002 \text{ (kg} \cdot \text{cm} \cdot \text{sec}^2\text{)}$$

4. Total weight

$$W = Ws+Wc+Ww=0.19 \text{ (kg)}$$

5. Total moment of inertia

$$W = Js+Jc+Jw=0.0085 \text{ (kg}\cdot\text{cm}\cdot\text{sec}^2\text{)}$$

The allowable R-axis moment inertia is 0.01 (kg·cm·sec^2), so there is no problem with the above point.

3 Robot allowable duty

To prolong the YP-X series robot service life, operate the robot within 80% of the allowable duty ratio

$$\text{Duty (\%)} = \frac{\text{Operating time}}{\text{Operating time+ OFF time}} \times 100$$

⚠CAUTION

Service life may be shortened if the robot is used for longer than its allowable duty time.

For instance, if we set a job operation where work is gripped at point A, placed at point B and then again returned to point A, all as one cycle taking place in 1 second, then the allowable duty is 70% which we calculate as:

$$80\% = \frac{\text{Time needed for round-trip between A and B of 0.8 sec.}}{\text{0.8 sec. for round-trip between A and B + 0.2 sec. for work transfer at points A\&B}}$$

Note that a time of at least 0.2 seconds is needed for stopping at points A and B.

4 Allowable overhang

The table below shows the allowable overhang for the YP320X, YP330X, YP220BX robots. This is calculated under the conditions that the Z-axis linear guide travel life is about 20000 km, acceleration is 100%, and maximum speed is 100%.

Payload W	Allowable Overhang L
0≦W≦1kg	140mm
1＜W≦2kg	50mm
2＜W≦3kg	30mm

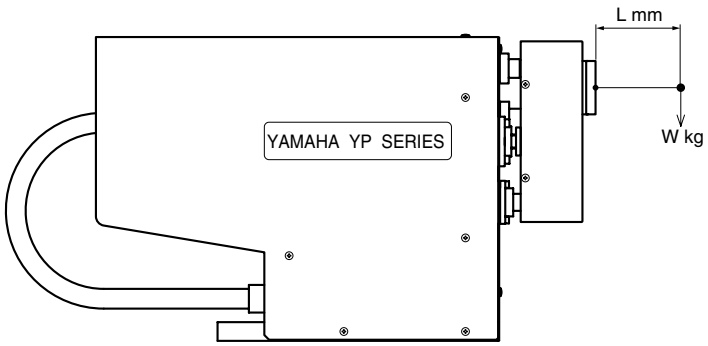


Fig. 6-26

⚠CAUTION

Although the robot can be operated with an overhang load exceeding the values listed in the above table, this will cause premature wear or damage to the drive unit (especially linear guide). In contrast, operating the robot with a smaller overhang load will extend the service life of the drive unit.

5 X-axis droop

Because of the one-sided support structure, the YP-X series manipulator arm droops downward slightly when it moves to the X-axis stroke end (forward end). The amount of droop during a maximum stroke on the X-axis is shown in the table below.

Payload W	YP320X	YP330X	YP340X	YP320XR	YP220BX	YP220BXR
0≦W≦1kg	1.0	1.1	1.5	1.4	1.0	1.1
1＜W≦2kg	1.2	1.3	-	-	1.1	-
2＜W≦3kg	1.4	1.5	-	-	1.2	-

X-axis maximum stroke
YP320X, YP330X, YP320XR: 330mm
YP220BX, YP2220BXR, YP320XR: 200mm

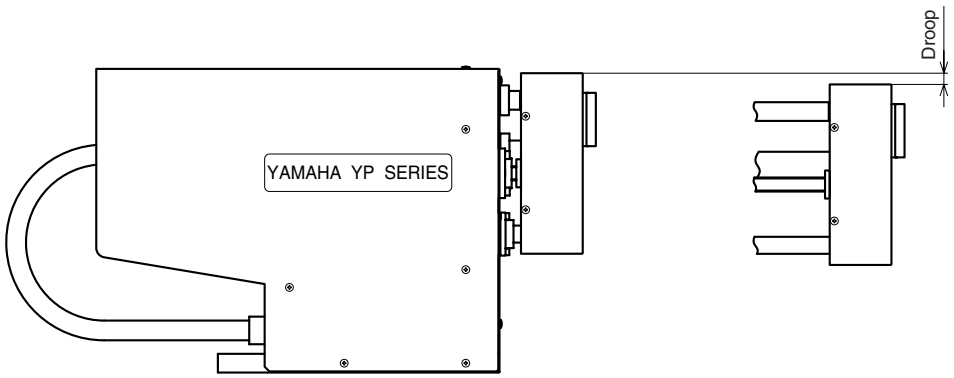


Fig. 6-27

6 Mechanical stopper

A urethane damper is installed to absorb the shock when an impact occurs with the mechanical stopper, so a certain amount of overrun occurs when the robot strikes the mechanical stopper. Use caution and take overrun into account since the end effector may interfere with the robot body and peripheral equipment or the robot body may interfere with the peripheral equipment. Maximum overrun amounts are listed below (for normal operation, maximum load mass, maximum speed).

(mm)

Robot Model	X-axis		Y-axis		Z-axis	
	Origin side	Opposite side	Origin side	Opposite side	Origin side	Opposite side
YP320X	3	3			2	2
YP330X	3	3	4	3	2	2
YP340X	3	3	4	3	2	2

⚠CAUTION

The mechanical stopper position cannot be changed, so select the robot with the optimum movement range taking the overrun shown above into account.

⚠CAUTION

Since the R-axis has no mechanical stoppers, make certain that the end effector wiring and tubing do not become entangled during operation or return-to-origin.

MEMO

OWNER'S MANUAL

YAMAHA PICK&PLACE ROBOT YP-X SERIES

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